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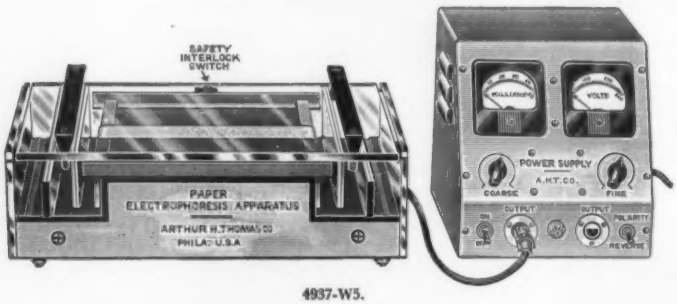

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The Scientist's Responsibility for the Interpretation of Concepts to Laymen[1]

Kirtley F. Mather

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IN today's world, there is great popular respect for the scientist as a technician dealing with nutrition and food supplies, with remedial drugs and health, with increased efficiency in transportation and communication, with mechanical marvels and wonder-working calculating devices. Even the new and truly revolutionary weapons of modern warfare, for which he is responsible, are applauded by many grateful citizens. In so far as the inventive genius of the scientist is applied to things, he is regarded with admiration and approval by the recipients and users of the new machines, materials, and techniques.

But there is great popular skepticism concerning the ability of the scientist in the areas of economics, politics, and social organization. His willingness to appraise, as objectively as possible, all proposals and suggestions from whatever source is bad enough. His readiness to try experiments that might challenge long-established, time-hallowed procedures is even worse. And when one comes to international affairs, the scientist's deeply embedded sense of fraternity among those who seek knowledge in the same field of investigation, regardless of their nationality, is almost certain to expose him to the charge that he is "soft" in his thinking about the United States vis-a-vis other nations.

This low appraisal of the scientist-as-citizen is an important aspect of the anti-intellectualism that today appears all too commonly in the climate of public opinion. It has been encouraged and strengthened by conservative politicians and demagogues who say to the scientist, in effect: "Continue your research. Improve the machinery. Design new gadgets. Create more powerful weapons. But stick to your laboratories. We will determine how, and for what purposes, all these things shall be used in practical, everyday life."

The age-old cleavage between the idealistic scholar and the hard-fisted man of affairs has not been effectively healed by all the expenditure for universal education upon which the founders of our republic placed such emphasis as the preserver of democracy. Moreover, a chasm, with somewhat different orientation, is widening between a scientific "elite" and a nonscientific "herd," despite all the valiant efforts of those engaged in education at all levels from the kindergarten to the adult education center. The danger to the unity and therefore the welfare and security of our nation is obvious.

There is of course an almost insurmountable barrier of vocabulary between the specialist in nearly every field of scientific research and the man-in-the-street who lacks training in the specialist's particular subject. But the vocabulary barrier is not a threat to the community. Indeed it exists between scientists themselves, without preventing such cooperative activities and such unity of spirit as are exemplified in the meetings of the broadly inclusive Association under whose auspices we meet today.

There is also the well-known schism between the directives of reason and the mandates of emotion that has frequently been viewed with alarm, and rightly so, but this is not the crux of the matter now in hand. Sad indeed would be the day—which fortunately will never come—when human emotions are completely expurgated by the searing flame of pure reason. Rather, let us strive merely to purify our emotions a bit; use reason now and then to help us distinguish between worthy and unworthy emotions; retain a judicious mixture of the two elements of life that when properly yoked can go far toward making life worth while.

The chasm to which I have referred is much more fundamental. It separates those whose minds are frequently and skillfully engaged in conceptual thinking from those who have neglected to cultivate that peculiarly human, mental ability. It distinguishes those who actively seek insight and meaning, from those who merely know how to do that which they have been trained to do. On one side are the minds constantly alert to the possibility of new generalizations and relationships; on the other are minds stocked with a greater or lesser array of factual data, but insecure and frustrated because of inability to make adequate adjustment to new experiences or circumstances.

I have referred to a scientific "elite," divided by this chasm from the rest of the world, but I am not sure that the adjective is correct. A similar distinction may be made among artists; here the contrast is between the maestro and the imitator, the truly great artists, few in number, and the host of lesser artists. Likewise in religion, the same distinction may be made between the prophet and the priest. In politics, a similar gulf commonly separates the statesman from the mere politician. But within the framework of this

[1] Summary of paper presented in the AAAS Section K symposium, "The Individual Scientist in Today's World," Dec. 29, 1953.

scientific gathering, it is appropriate to focus attention upon those aspects of the problem that affect the vitality and usefulness of science.

For science and the scientist this separation of mankind into two disparate groups poses an increasingly poignant problem. Scientific research is becoming ever more dependent upon popular support. There is no reason for anxiety about the support of practical applications of scientific concepts or the technologic development of new ideas conceived in research laboratories. Industrial progress and military strength depend so obviously upon the technician that his comfortable niche in the social structure is indefinitely ensured. In sharp and dangerous contrast, the continuing support of fundamental research, as distinguished from applied science, is in a sadly precarious position. Such research requires financial backing. It also requires an environment of freedom. The present climate of public opinion is scarcely favorable for either.

The responsibility of the scientist for ameliorating that climate is both selfish and unselfish. He desires, of course, a better opportunity for his own personal achievements and he has deep commitments to the progress of science in general. But he is also responsible for human welfare and the health of society at large. He knows that in the last analysis the security of the nation depends upon the vitality of the fundamental research in which its creative scientists are engaged.

To respond victoriously to the challenge implicit in the contemporary ebb of confidence in science and scientists, it is necessary for the scientist to interpret his work to the layman in terms of concepts and mental constructs, rather than in terms of gadgets and applied techniques. This interpretation, however, must be something more than an inculcation of knowledge concerning the new concepts of each new stage in the forward march of science. It is the process of conceptual thinking that must be explained, the scientific habit of mind that must be made attractive.

Fortunately, conceptual thinking is not nearly as esoteric as many seem to believe. The human brain normally and constantly scans the sense data of experience to select those that seem to have significance. Patterns are perceived in the regularities of occurrence or relationship. Concepts that explain, or account for, the observed regularities and patterns are a result of the natural functioning of the brain. Even the simplest and most primitive of concepts lead to prediction and further observation and generalization.

The fundamental concepts of even the most complicated of modern sciences can be comprehended by almost everybody. That, indeed, is one of the earmarks of a fundamental concept; it explains what appears to be complex and chaotic in terms of relationships that give significance and meaning. Concepts are mind-stretching; they enlarge the horizon of one's mental grasp. They are also mind-satisfying; they rejoice the spirit of man. These satisfactions that every scientist feels when he has successfully used inductive reasoning to solve his problems can be shared by most laymen.

Scientists are handicapped in their endeavor to share fundamental concepts with the layman because they have not yet succeeded in sharing fundamental concepts with one another. The process of conceptual thinking is, however, universally acclaimed by every research scientist, and its power and virtue are known to all who have made effective use of it. Its nature can therefore be proclaimed with a unanimous voice, a voice that will carry across the chasm and make at least some impact on the attitudes of those within range.

It will, however, be necessary for scientists to seek concepts that unite not only the sciences with one another, but also the sciences with the arts and the humanities. That such concepts can be found is a part of the faith of many modern men. It is in fact a faith that is held implicitly if not explicitly by every man who seeks a truly satisfying philosophy of life, who really believes that life has meaning. When found, such ineffably basic concepts should be proclaimed to all the world.

As a first approximation to a universal, fundamental concept, I would suggest that the concept of order in the universe is basic in all science. The regularity may be of a statistical nature, rather than individual, but the result is orderliness just the same. There is indeed much evidence even of spiritual law in the world of nature.

The concept of a universe of law and order has fallen into sad neglect in these years of our lives. Chaos seems to be a characteristic of modern life. The old foundations have crumbled. Ancient verities no longer undergird the morals and ethics of modern man. To a distraught society the scientist may speak words of wisdom.

Freedom is a function of order, not of disorder. It may be found only within the pattern or framework of an orderly universe. And that is the universal pattern which scientists discern.

Much progress has already been made in the search for the basic concepts that will integrate the many segments of knowledge and of life that now seem fragmented and unrelated. Many men, working in widely varied disciplines of thought, are actively concerned with this search. The Foundation for Integrated Education, of which I have the honor to be president, has brought a few such researchers together. But this is in its very nature a cooperative enterprise and more workers are needed. With research, education must be combined, as indicated by the name of the Foundation. Too much of our so-called "General Education" is concerned with the acquisition of factual data culled from a broad array of sources. It is conceptual thinking that should be stressed; integrative concepts that should be made known.

Here then is the contribution that scientists may make toward the ordering of our chaotic world. More widespread understanding of the scientific approach to knowledge may yet save that world from disintegration.

Electron Microscopy in Latin America[1]

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A recent publication of the UNESCO (Boletín del Centro de Cooperación Científica de la UNESCO para América Latina, No. 2, 4–20, Junio-Julio 1952) presented a review and bibliography of electron microscopy in Latin America. The present extract epitomizes the features of principal general interest in this report; the original (in Spanish) should be consulted for a full discussion and for references.

THE FIELD of the electron microscope (the structure of matter in the level of dimensions from 10 to 10,000 A) includes macromolecules and structures revealed by the optical microscope. The electron microscope thus has many applications in physics, chemistry, and biology, including specialties such as metallurgy and medicine. It is therefore important to develop in Latin America suitably equipped centers for electron microscopy. The present position is examined in this report.

Most of the 25 microscopes installed to date were made by the Radio Corporation of America. The Philips Company of Holland has supplied at least three microscopes, the Siemens Company, one. All RCA models except the EMT are represented, but our inquiry developed no direct information about nearly half of these, the 9 Models "C." Indirect information indicates that the majority of these are not in use. Of the 11 RCA microscopes EMU, the majority are in use and some have produced results. The Philips and the Siemens research microscopes were but recently installed.

A survey with questionnaires to the principal centers of electron microscopy in South America developed the following information:

Electron Microscopy Section, the Naval Hospital, Buenos Aires, Argentina.—During the last five years, under the direction of Dr. Mario G. Malfatti, various biological and medical subjects have been studied, with 12 publications including work on the pigment of melanosarcomas, on alastrin, *Pasteurella aviaria*, rabies virus, the Género Candida, *Mycobacterium tuberculosis* var. *hominis*, pulmonary silicosis, *Mycobacterium leprae*, and on *Vibrio cholerae*.

Malbrán Bacteriological Institute, Virus Section, Buenos Aires.—Under the direction of Dr. Armando S. Parodi, work has been done on the cytology of the mammary gland and the complex nature of mitochondria, with one paper in press.

Instituto de Suelos y Agrotecnia del Ministerior de Agricultura y Ganadería de la República Argentina, Buenos Aires.—Dr. M. A. Servici de Rondini directs studies that include clays, soil colloids, soil microorganisms, and plant viruses (two papers).

Sección de Microscopía Electrónica de la Escuela Politécnica de la Universidad de São Paulo.—The well-equipped section of electron microscopy at the University of São Paulo (Brazil) Polytechnic School, directed by Dr. P. Ribeiro de Arruda, is primarily dedicated to work in the chemical and biological fields. Diatom identification, classification of Brazilian clays, morphology of proteins of cobra venom, the evolution of yeasts in various media, the electron bombardment of specimens, and especially of protein from peanuts, have been studied. A bibliography of 15 works, including review and technical papers, exists.

Sección de Microscopía electrónica del Instituto Oswaldo Cruz de Rio de Janeiro, Brazil.—This section, directed by Dr. Hans Muth, addresses the broad interests of the Institute in biology and medicine. Studies started in 1951 include the morphology of bacteria and of *Spirogyra* and protozoa, and various species of insects. Some crystalline substances have been analyzed. One paper has been published on the olfactory organs of *Papilio polystictus* Btlr. and *proneus* Hbn. (Lepidoptera).

Séction of Electron Microscopy, Instituto Butantán, São Paulo, Brazil.—This unique Siemens electron microscope UM 100b was installed October 1952 in a well-equipped laboratory for the study of biological problems, primarily in virus research, under the direction of Dr. A. Vallejo-Freire. The absorption of viruses, the surface of snake scales, the spermatozoa of snakes, the morphology of aluminum oxide, the structure of insect muscle, inorganic gels, and the relation between tissue and foot-and-mouth disease and yellow fever viruses are being studied. Four papers have been prepared.

Departamento Federal de Seguridad Pública, Rio de Janeiro, Brazil.—This EMC microscope, under Dr. A. C. Villanova, is used for studies of clays and kaolins.

Instituto de Biofísica, Facultad Nacional de Medicina, Universidade do Brazil, Rio de Janeiro, Brazil.—This Philips microscope, installed in 1952 and under the direction of Dr. Hertha Meyer, is being used for studies of nerve fibers, of cell-parasite relations *in vitro*, and of the multiplication of viruses in bacteria.

Departamento de Ultraestructura celular del Instituto de Investigación de Ciencias Biológicas, Montevideo, Uruguay.—This department for the study of biological material, directed by Dr. E. De Robertis,

[1] Extracted and revised by A. R. T. Denues and E. Valez, Sloan-Kettering Institute for Cancer Research, New York City. Written under a grant from the Alfred P. Sloan Foundation.

has an improved RCA-EMU microscope, installed in mid-1950, and all facilities for auxiliary techniques and maintenance. The development of techniques for biological material includes the culture of tissues, especially nerve, on parlodion films, ultramicrotomy, a special technique for leukocytes and platelets, and a technique for macromolecules dispersed as aerosols and electrostatically precipitated. Biological, medical, and veterinary problems studied include nerve structure, elastic fibers, bacterial flagella, foot-and-mouth disease virus, anaplasmosis, myxomatosis, and the ciliary and neuromotor apparatus of *Tetrahymena geleii*. Studies are now being made of the virus-cell relation in myxoma of the rabbit, of the ultrastructure of cilia and neuromotor apparatus of infusoria, and of plasma particles associated with mouse leukemia. Nineteen publications have been prepared.

Conclusion

Considering the number of instruments, about 25, the results obtained so far are disappointingly few. Only a few laboratories are working in full, and producing original results. Contributory factors seem to include the following: a lack of scientific personnel specially trained for ultrastructural studies; a lack of technical personnel for the repair and maintenance of the instruments; poor choice of instruments (about half are of a model of limited usefulness); a general lack of supplementary instruments and facilities for auxiliary techniques; the lack of replacements, for maintenance; customs regulations that seriously impede electron microscopy in Latin America.

In line with the interest of UNESCO in forwarding this new discipline and scientific progress in Latin America, the following steps are recommended: fellowships to specialized centers for ultrastructure in the United States, Europe, or Latin American countries; improved interchange of technical information through periodical meetings of specialists in the field, and perhaps the formation of a society for studies of fine-structural problems in Latin America; modification of customs regulations to expedite the import of replacement parts; improved facilities for maintenance of electron microscopes; and an intensive theoretical and practical course in electron microscopy at a Latin American center.

Pasadena Conference on the Structure of Proteins

John T. Edsall

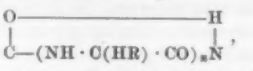
University Laboratory of Physical Chemistry, Harvard University, Boston 15, Massachusetts

A SMALL GROUP OF INVESTIGATORS, active in the study of protein structure by x-ray diffraction and other physical methods, met at the California Institute of Technology, Pasadena, on September 21–26, 1953, in a conference organized by Linus Pauling. In many respects the conference could be regarded as a direct continuation of a discussion held by the Royal Society in London on May 1, 1952 [*Proc. Roy. Soc. London* **141B**, 1–103 (1953)]. Indeed, many of the participants were the same in both meetings. However, while the meeting in London had occupied only a single day, five days were fortunately available for discussion in Pasadena, so that an opportunity for constant and repeated interchange of ideas between the participants was possible over a relatively prolonged period. The conference was outstanding for the number of distinguished British participants involved, including Sir Lawrence Bragg, W. T. Astbury, J. T. Randall, M. F. Perutz, J. C. Kendrew, D. P. Riley, A. Elliott, F. H. C. Crick, I. MacArthur, M. H. F. Wilkins, and I. F. Trotter. The conference was made possible by the support of the Rockefeller Foundation, the National Foundation for Infantile Paralysis, and the American Institute of Biological Sciences in conjunction with the Office of Naval Research.

At the beginning the discussion was centered on recently determined structures of amino acids and peptides, and their implications for protein structure. R. Pasternak discussed the structure of glycyl-asparagine, which further confirms the planarity of the amide group and the adjoining carbon atoms in the fundamental repeating unit (—C · CO · NH · C—), and other features of peptide structure already established. E. W. Hughes reported his work with H. Yakel on N,N′-diglycylcystine, establishing accurate values for the distances sulfur-sulfur (2.04 A) and sulfur-carbon (1.87 A) and for the S—S—C angle (103°); the whole structure is of importance in the consideration of cross-linkages between polypeptide chains which involve cystine disulfide groups.

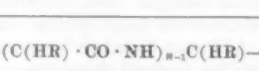
The discussion then turned to possible helical configurations of polypeptide chains. Barbara W. Low discussed the configuration of the π helix, in which each CO group is hydrogen-bonded to an NH group four residues beyond it along the polypeptide chain. She described some of the relationships within and between the two different families of polypeptide

chain helices which may be called the "α" and "γ" series. The helix belongs to the "α" series, that is, it corresponds to the chemical sequence



where $n=4$, and there are 16 $(3n+4)$ atoms in the hydrogen-bonded loops so formed. Four helices of the "α" class have thus been described: "α"$_{n=1}$ corresponds to the 2_7 or α_{II} configuration; "α"$_{n=2}$, to the 3.0_{10} helix; "α"$_{n=3}$, to the α helix of Pauling and Corey; and "α"$_{n=4}$ is the π helix. It is readily seen by examination of models that all the helices of the "α" series can be interconverted by relaxing or tightening the "wrap up" without complete unwinding.

The residue unit $(—C_1 \cdot C_1'O \cdot N_1H \cdot C_2—)$ configuration in the "γ" series is markedly different from that in the "α" series, both the CO and NH groups being sharply inclined to the helical axis with the $C_1—C_1'$ and $N_1—C_2$ bonds practically perpendicular to this axis. The members of this series correspond to the chemical sequence



with $3\ (n-1)+5$ atoms in the hydrogen bonded loop so formed. For the "γ" helix, $n=5$. Transition between helices of the "γ" series corresponds to relaxation or tightening of the "wrap up." Interconversion between helices of different series is not possible without complete unwinding and rewinding. As yet there is no evidence that a helix of the "γ" series exists in any natural or synthetic protein or polypeptide. There is strong evidence for the reality of the α helix of Pauling and Corey, but as yet no clear evidence for other helices of the "α" series has been produced. These relations are further discussed by J. Donohue, *Proc. Natl. Acad. Sci. U.S.* 39, 470 (1953) and by B. W. Low and H. J. Grenville-Wells, *ibid.*, 785.

J. Donohue discussed the energy relationships and relative stabilities for six helical structures, four of the "α" series including 2_7 or α_{II}, 3.0_{10}, α, and π, and two of the "γ" series 4.3_{14} and the γ helix itself. He concluded that the stabilities of the five structures in which the hydrogen-bond angle is less than 20° are in the order

α, (3.6_{13}); π, (4.4_{16}); 2_7("α"$_{n=1}$); 3.0_{10}("α"$_{n=2}$); γ(5.1_{17}); 4.3_{14}("γ"$_{n=4}$).

The numerical subscripts denote the number of atoms in the hydrogen bonded loops; the numbers to which the subscripts are attached denote the number of residues in a complete turn of the helix. The coordinates of the β-carbon atom are different in the left-handed and right-handed forms of the same helix, and the radial distribution functions are, therefore, also different. Donohue reported that, for the π helix, the radial distribution functions of both left- and right-handed structures are similar to each other and to the α helical function. There was a very active discussion of the significance of radial distribution functions derived from x-ray scattering in powdered preparations in discriminating between left- and right-handed helices and between the α helix and other configurations. D. P. Riley took a leading part in this discussion and presented extensive data that he had obtained on many proteins, which could be interpreted in terms of the α helix in one of the other of the two possible configurations α_1 (left-handed screw with β carbon in Pauling's position 2) and α_2 (right-handed screw with β carbon in Pauling's position 1). Pauling discussed the problem of bending the α helix, especially in terms of the effect of proline and of the introduction into the sequence of one or more loops with 16 atoms in the hydrogen bonded loop (π configuration). Bending must be considered, since the evidence for many corpuscular proteins appears decisive in indicating that a number of bends must occur in the chains in order to pack them into the dimensions indicated from our general knowledge of the sizes and shapes of protein molecules. The insertion of a proline residue in a peptide chain eliminates one possible hydrogen bond and disturbs the repeating pattern of the helix. Models can be constructed in which bending around a corner can be achieved if the existence of hydrogen bonded loops with 16 atoms in the loop (as in the π helix) is assumed in the immediate neighborhood of the proline residue. To permit the helix to bend around a corner and reverse its direction, at least two intrachain hydrogen bonds must be broken which would normally be present in the straight helix.

The second day began with an active discussion of the structure of muscle and other α proteins. W. T. Astbury reviewed the natural α structures with particular stress on recent work on bacterial flagella. R. S. Bear discussed characteristic features of the diffraction patterns of paramyosin of molluscan muscles, and of another component (probably actin) which is observed in all muscles. These diffract at small angles according to a well-defined "selection rule" which has been known for some time: $n=(k-mG)/T$. Here all symbols are integers; k is the layer-line index, n expresses the distance of the observed intensity maxima at a given layer line from the pattern meridian, G and T are numbers characteristic of the fiber involved, and m is any positive or negative integer yielding the observed range of $n=0$ to ± 2. Two possible interpretations of these findings are available. One interprets them in terms of a large-scale net structure, which is also suggested by the electron microscope studies of Schmitt, Hall, and Jakus on paramyosin. The alternative interpretation is in terms of the transform of a helical structure as suggested by Cochran, Crick, and Vand; T and G could be alternatively the respective number of turns and the number of equivalent scattering centers, both per axial period of a discontinuous helix. For the "actin" pattern of muscle, $G=15$, $T=7$, and the diameter of the corresponding helix would be 50 A. The ambiguity of interpretation as between the proposed net or helical structures must be resolved by further work. H. E. Huxley then discussed his recent remarkable studies in the electron microscopy of

muscle, which reveal different types of parallel rod-shaped structures, some of diameter about 110 A, others near 40 A. Evidence was given that the former are probably bundles of myosin and the latter of actin.

There was a lively discussion, principally by F. H. C. Crick and Pauling, regarding the bending of α helices; model structures can readily be constructed involving triple ropes or seven stranded cables, and such models may account for some of the discrepancies between the x-ray patterns of the natural α proteins and the simple long chain polyamino acids, some of which at least appear to be simple α helix structures. Crick proposed that the very nature of the side chain packing in closely adjacent α helices would tend to make them fit together with an angle of approximately 20° between the axes of the individual helices. Astbury, Low, and others pointed out the difficulties of effecting the dynamic transformation from the α helix to an extended β form; it was agreed that the stretching of a coiled coil would probably be a very difficult matter even if the disulfide cross-linkages were broken and almost impossible if these were maintained intact. However, the evidence for such structures as coiled coils or seven stranded cables appears to be plausible enough to require serious consideration. R. E. Marsh discussed the structure of silk; the x-ray patterns fit in well with the assumption of repeating glycyl-alanyl residues in the crystalline portion of the structure, and the repeat distance of 7 A is compatible with the anti-parallel pleated sheet structure of Pauling and Corey.

In the afternoon there was some discussion of infra-red data with particular emphasis on their use in discriminating between the α and β configurations of polypeptide chains. G. B. B. M. Sutherland presented numerous infra-red spectra of proteins and synthetic polyamino acids. A. Elliott discussed the evidence for the correlation of absorption bands at 1660 and 4600 cm^{-1} with the α, and at 1630 and 4530 cm^{-1} with the β configuration. Questions were raised by Sutherland and others as to the extent to which the infra-red and the x-ray data on α and β configurations could be correlated. Elliott emphasized that one should not expect high quantitative accuracy in correlating the intensities of the bands with the percentage of the α or β form in any particular structure. I. F. Trotter presented excellent and detailed x-ray data on poly-L-alanine that were in general in close accord with the α helix structure with 3.615 residues per turn. Poly-alanine in the β form gave an x-ray diagram in good agreement with what was to be expected for the pleated sheet structure of Pauling and Corey; interesting relations to the structure of silk were also indicated.

There was a very active discussion on collagen. Bear concluded that the wide angle diffraction pattern of collagen is best accounted for by assuming an axial period of 28.6 A which would contain 10 equivalent scattering groups arranged in three turns of a discontinuous helix. It had been suggested earlier that each equivalent scattering group contains three amino acid residues. Careful consideration of the density of collagen, which is probably near 1.41 rather than 1.35 as usually assumed, together with other considerations, suggest that there may be as many as four residues per equivalent scattering group. This would give $7 \times 4 = 28$ residues along three turns of the chain helix in a period of 28.6 A. R. Pasternak also discussed recent data obtained in Pasadena which are generally in satisfactory agreement with those of Bear as far as the experimental findings are concerned, although some differences of interpretation remain. Astbury reported on new studies of the stretching of collagen by K. M. Rudall which may indicate transformation of collagen to the β configuration. Pauling emphasized that he had given up his own earlier views on the structure of collagen but was not yet ready to propose a new one. F. O. Schmitt presented his recent work with J. H. Highberger and others on the formation of two types of structures with spacings greater than 2000 A, denoted respectively as segment long spacing and fibrous long spacing structures. He pointed out the reversible interconversions possible between normal collagen, with its period of 640 A, and the two types of long spacing structures. The presence of ATP was found to be important for the formation of the segment long spacing structures. J. T. Randall discussed the developmental changes of collagen in the embyo.

On the third day the discussion was centered on the globular proteins. Sir Lawrence Bragg discussed the analysis of the x-ray diffraction patterns obtained with protein crystals, in particular the pattern due to the '*b*' projection of horse hemoglobin. [The basis of this work is presented in the Royal Society discussions already quoted and in an article by Bragg and Perutz, *Proc. Roy. Soc.* **A213**, 425 (1952).] It is a very complicated matter to determine the phases corresponding to the spots in the pattern, which must be known before a Fourier picture of the molecule can be made. By a study of hemoglobin crystals at various stages of swelling and shrinkage, nodes and loops along the layer lines of the transform can be outlined and many sign relationships established. (Since the '*b*' projection is centrosymmetrical, the determination of phases reduces to the problem of assigning a positive or negative sign to each term.) M. F. Perutz continued the discussion and showed how all remaining uncertainties about the signs had been cleared up. Rapid progress has been made recently by the preparation of crystals in which *para*chloromercuribenzoate is combined with the two sulfhydryl groups of the hemoglobin molecule. These crystals are isomorphous with the normal form, and the heavy mercury atoms produce a measurable change in the intensities of the x-ray reflections. In conjunction with the earlier work, these changes permit signs to be determined and make it possible to calculate the position of the mercury atoms and to draw a projection of the hemoglobin structure on the *b*-plane. The analysis has so far only been carried out for the inner part of the diffraction pattern, so that detail finer than 7 A is not shown in the Fourier. However,

the success of the method holds out promise that it can now be applied to get pictures with high resolution. Also heavy atoms may be attached to other key groups in the molecule and reveal their positions. J. C. Kendrew presented results on a series of crystals of myoglobin obtained from at least six different species of whales, from porpoises, and from penguins. Some of these crystals are considerably more suitable for x-ray study than those of horse myoglobin. Previous notions about the dimensions of the myoglobin molecule may require some revision. It now appears to be about 40 A long with a cross section of about 900 A^2. The data accumulated recently are so numerous that there has not been time to evaluate their full significance. D. Harker discussed the progress of the work on protein structure from x-ray analysis at the Polytechnic Institute of Brooklyn. Techniques have been devised for the rapid collection of intensity data using a Geiger counter. Five different forms of crystalline ribonuclease have been obtained, and preliminary data are available on them all. The program is of long range and most of the results are still to come. V. Luzzati gave a theoretical discussion of intensity distributions in systems containing large numbers of atoms with an assumed type of random distribution.

The morning discussion on the fourth day was entirely devoted to desoxyribonucleic acid (DNA) structure. Major emphasis was laid on the structure recently proposed by J. D. Watson and F. H. C. Crick [*Nature* **171**, 737 (1953)]. The evidence is clear from the x-ray data that the structure must be helical, and there appear to be compelling reasons for assuming a double helix involving two chains running in opposite directions and held together by hydrogen bond cross-links between adenine and thymine and between guanine and cystosine. This is in good accord with recent analytical findings of Chargaff and others indicating a 1:1 ratio of purines and pyrimidines in DNA. M. H. F. Wilkins discussed the evidence from the recent and beautifully detailed x-ray studies on crystalline DNA at King's College, London [Wilkins, Seeds, Stokes, and Wilson, *Nature* **172**, 759 (1953)]. The patterns from many different biological sources are indistinguishable, although the ratios of the bases differ markedly from one species to another. The crystalline like the paracrystalline form of DNA appears definitely to be a double helix; the former probably contains 11 nucleotides per turn of the helix. The nucleotides appear like a series of rods, inclined to the fiber axis at an angle of about 65°, in a sense opposite to the inclination of the helix. J. T. Randall discussed the recent work in the same laboratory demonstrating that DNA can be fractionated into different portions in which the ratio of adenine: guanine varies from 0.7: 1.3. M. Delbruck, F. O. Schmitt, and others discussed the biological significance of the structure proposed by Crick and Watson in relation to mitosis and to crossing over.

On the final day of the conference after a further discussion of the collagen studies, there was a lively discussion between D. P. Riley and Barbara W. Low regarding the structure of insulin. Riley from his radial distribution studies concludes that one chain of insulin (the B chain) is in the α_2 (right-handed) configuration, the A chain being presumably α_1. Low presented her studies on the structure of acid insulin sulfate and the clear-cut evidence for parallel rod-shaped structures from the three-dimensional Patterson diagram. Since the amino acid sequences in both A and B chains are known, the chief remaining chemical problem is the arrangement of the disulfide linkages. This would determine whether the molecule has four (2A and 2B) or two (A and B) chains. Model studies based on the α helix suggest certain possible interchain linked structures and show that the intrachain disulfide linkage required in the two-chain structure cannot be formed without very marked distortion.

Several major developments emerged from the discussion. The evidence for the reality of the α helix as the basis of structure, not only for synthetic polypeptides but for a number of proteins, appears increasingly strong. Generalized relations for the description of possible helical structures in polypeptide chains, together with criteria for their relative stabilities, have been formulated. The insertion of heavy atoms at defined points within the hemoglobin structure has opened a great realm for further investigation which promises to be extraordinarily fruitful. Knowledge of the structure of collagen has deepened and widened. The recent advances in the structure of DNA promise to be of almost revolutionary importance. However, the most important aspect of the conference was probably not in the explicit formulation of these established advances so much as in the constant interplay in the discussion involving the tentative presentation of half-formulated thoughts. Although much of the time had to be given to somewhat formal presentations, the greatest effect of the conference was undoubtedly in the opportunity which it provided for the germination of newer and more tentative ideas.

Charles Leonard Huskins: 1897-1953

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WITH the untimely death of Charles Leonard Huskins on July 26, 1953, at the age of 55, the scientific world lost an internationally distinguished biologist, a dynamic, colorful personality, and an outstanding educator.

Professor Huskins was born in Walsall, England, on Nov. 30, 1897, the son of William Huskins and Annie Clara Darby Huskins. At the age of nine he moved, with his family, to Red Deer, Alberta, Canada. During World War I he enlisted and served overseas in the Canadian Infantry (1916). However, he was attracted by the rapidly expanding Royal Flying Corps (later the R.A.F.), and served as a flying officer in England and France (1917–19). He helped defend London against the Zeppelins and liked to recall that he celebrated the Armistice by flying low around Nelson's column in Trafalgar Square. During World War II he was active in the C.O.T.C. and the McGill unit of the R.C.A.F.

After the war he returned to Canada and enrolled at the University of Alberta, from which he received the degree of Bachelor of Agricultural Science in 1923 and the master's degree in 1925. His outstanding promise as a young scientist was recognized as a result of his investigation of certain genetic phenomena in oats and he was awarded an "1851 Exhibition Overseas Scholarship" for graduate study. He returned to England and by 1927 had obtained his Ph.D. from Kings College, University of London, which later (1934), on the basis of his published research, also awarded him the D.Sc. degree. From 1927–30 he worked under William Bateson as a research fellow in cytology at the John Innes Horticultural Institution in England.

His teaching career began in 1930 at McGill University, first in the Department of Botany and later (1934–1945) as professor and first chairman of the Department of Genetics. This department was organized largely for, and because of, Dr. Huskins. It was the first and is still the only university Department of Genetics in Canada. He was very proud of the cytogenetics group that flourished under his direction at McGill, and for this reason he was reluctant to leave and to accept a post as professor of botany at the University of Wisconsin (1945–1953). Except for a number of brief visits to various European institutions, a term as visiting professor at the University of California in 1938, and a year as a Guggenheim fellow at Columbia University in 1942–43, his academic career was spent at McGill and Wisconsin.

He was active in many professional organizations. Despite his Wisconsin residence, he was president of the Biological and Medical Sciences Section of The Royal Society of Canada in 1951. While at McGill, Professor Huskins gave active support to the National Research Council of Canada and worked hard to develop and improve the *Canadian Journal of Research*.

In 1923 he married Margaret Villy, a writer and at that time a lecturer in English literature at the University of Alberta. She was a person whose exceptional artistic and spiritual qualities contributed greatly to their home and community. Both Professor and Mrs. Huskins were deeply concerned with the work and growth of the Madison Unitarian Society. She died in March, 1953. They are survived by three children: Sheila Wincot (Mrs. S. Hori), Olwen Margaret, and John Michael.

Professor Huskins' scientific investigations represented pioneering work on a number of fundamental biological problems. His early work was concerned with understanding the nature of certain mutations in oats and wheat. During his stay at the John Innes Horticultural Institution he studied the cytology of certain grass species of the genus *Spartina* and a suspected hybrid. The cytological analysis showed the suspected hybrid to have the chromosome number predicted on the basis of hybridization followed by chromosome doubling. This is one of the first well-authenticated examples of the naturally occurring evolution of a new plant species and is now commonly cited in books and articles pertaining to plant evolution. From this study, his interest in chromosome morphology led to his well-known researches on the spiral structure of plant chromosomes. His fertile mind also delved into the problem of chromosome synapsis and the mechanism of crossing-over, and led him to study chromosome behavior in grasshoppers, mice, and higher plants. Later an interest in the ultimate structure of the chromosome (and hence the gene) culminated in a series of papers on the role of the chromosomes (and nucleus) in differentiation and development. During the last decade of his life he also developed a strong interest in certain aspects of the history and philosophy of science. His aim in this regard was to interpret the progress and role of cytology in the general framework of science and in its relation to society as a whole. Considerable time and thought were also devoted to the problem of the integration of science and religion.

Professor Huskins was keenly aware of the dangers of the interference of politics into the strictly scientific matters which led to the destruction of the science of genetics in Soviet Russia. He was likewise well aware of the personal misfortunes and the loss of scientific manpower that ensued. As a consequence, he

took an active part in helping a number of refugee scientists to reestablish themselves in North America.

One of his early convictions concerning his special field of biology was that the disciplines of physics and chemistry should be brought to bear on certain biological problems. He spent much time and effort trying to foster this approach, and his enthusiasm in this respect made a lasting impression on many of his associates and students to the great advantage of the sciences. He had a remarkable talent for synthesis, combining data and technics from a variety of fields of knowledge. This ability was of great value to his fellow committee members in organizing the curriculum of Integrated Liberal Studies at the University of Wisconsin. He emphasized the distinction between training and education, realizing that the function of the teacher is, in the words of Channing, "not to stamp our minds irresistibly on the young, but to stir up their own."

Professor Huskins was a vigorous and energetic man who often sought relaxation in physical exertion. For many years he spent his summer vacation and frequent winter ski weekends at his Vermont farm. He was exceptionally well liked by both undergraduate and graduate students. In the latter, he encouraged and developed an unusual degree of independence and originality. His relationship with them was always a friendly one, and he showed a genuine interest in their personal as well as their scientific welfare and advancement. He was a stimulating conversationalist, witty and quick to appreciate the humorous side of a subject. Among his students and associates there are few who will not remember many pleasant and stimulating hours spent in his laboratory, office, or home.

The written contributions of Charles Leonard Huskins will long preserve his scientific memory; his vivid personality will live on in the memories of his many friends.

Timothy William Stanton: 1860-1953

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IN the 11th Annual Report of the United States Geological Survey, C. A. White, geologist-in-charge of Mesozoic invertebrate paleontology, writes that "On July 1 [1889] Mr. T. W. Stanton, who had recently been appointed Assistant Paleontologist, reported to me for duty and immediately entered upon the work of the division." Thus was initiated a continuous period of some forty-six years in the public service, an experience that made Dr. Stanton one of the outstanding figures in American geology.

Timothy William Stanton was born in Monroe County, Illinois, September 21, 1860. His parents, William and Mary Ann Blanchard Stanton, were both of farmer stock and had come from North Carolina. In 1866 the family moved across the Mississippi River to Missouri, and Stanton began his education in the one room country school of the locality. In 1874 the family moved to Colorado and settled at Boulder, then a community of 2000 people. There young Stanton attended the public school, and in 1877, when the University of Colorado opened its doors, he became a preparatory student and in 1883 was graduated with the University's second class as a Bachelor of Science. In 1895 he received the Master of Science degree and in 1924 an honorary Doctor of Science degree from the same institution. In 1888–1889 he attended The Johns Hopkins University as a graduate student in biology and geology and in 1897 Columbian (now George Washington) University of Washington, D. C., awarded him the degree of Doctor of Philosophy.

After graduation from the University of Colorado in 1883, Stanton was connected for five years with the public schools of Colorado. In 1894, after moving to Washington, he became a part-time teacher of geology at Columbian University, and continued this connection until 1910.

In Colorado, Stanton lived in an area of Cretaceous rocks and became interested in them and their fossils. In the University the professor of mathematics was really a general naturalist and gave, among other courses in science, one in geology that Stanton took. This crystallized his interest and he concentrated on it. He published in 1888 his first paper on the fossils of the Pierre shale. It was natural therefore that his appointment with the Geological Survey should involve Cretaceous fossils. Up to 1889 White had been responsible for all work on Mesozoic invertebrates in the Geological Survey. In that year Alpheus Hyatt took over responsibility for Triassic and Jurassic invertebrates and White, with Stanton as his new assistant, restricted his work to Cretaceous invertebrates. In 1892 Stanton succeeded White as geologist-in-charge of work on Cretaceous invertebrates. In 1900 he became paleontologist, in 1903 geologist-in-charge of the Section of Paleontology and Stratigraphy and in 1912 chairman of the Committee on Geologic Names. In 1930 he became acting chief geologist and in 1932 chief geologist. He retired in September 1935 at the age of seventy-five. For some years afterward he revived interest in his early work on the Lower Cretaceous deposits of Texas, but he found the toll of years too heavy to permit the finishing of the large manuscript he had begun many years before and only parts of it were published. He busied himself with less exacting tasks and for his last fifteen years remained

inactive, so far as geology was concerned. He died December 4, 1953.

The primary duty of the paleontologists of the Geological Survey was, as it still is, the identification and evaluation of fossils for the field geologists of the Survey. Although this work involved considerable routine examination of collections, it seems to have occupied then only a minor part of the paleontologist's time and he had considerable freedom to carry out research. White sent Stanton into Texas in 1889 to gather data on the lower Cretaceous deposits of the region, a subject that remained a major interest for the rest of Stanton's life. He was also introduced to the Upper Cretaceous deposits of the Atlantic and Gulf Coastal Plain by a trip in October 1889 to the Ripley deposits of Mississippi. During the next ten years he extended his work to the Pacific Coast and continued to acquire an extensive first-hand acquaintance with the Cretaceous of the Western Interior region and the Coastal Plain. Particularly in this early field work Stanton made collections of fossils that have not since been surpassed for quality and scope. In 1902 Alpheus Hyatt died and the Survey's work on the paleontology of the Triassic and Jurassic rocks was added to Stanton's duties. The Geological Survey was growing and the burden of administration after 1903, coupled with the expanded work of routine examination of all Mesozoic collections for the Survey's geologists, left him little time for research. It is surprising that during his later active years he was able to produce as many important papers as he did.

One of his earliest field tasks was to study the Bear River formation of southwestern Wyoming. He showed in 1892 that all the earlier students had completely misplaced it and that instead of constituting a Laramie unit at the top of the Upper Cretaceous deposits, it really was associated with the earliest Upper Cretaceous beds. In 1883 he produced a description of the Colorado formation and its fauna, still a classic in American paleontology. His work on the Pacific Coast resulted in several papers on the stratigraphy of the Shasta and Chico sequences and a description in 1895 of the fauna of the Knoxville formation. He also for the first time recognized that the Martinez formation as originally defined was partly Cretaceous and partly Tertiary; since then the Cretaceous part has been excluded from the formation. With the paleobotanist F. H. Knowlton in 1897 he discussed the stratigraphy and paleontology of the Laramie and related formations of Wyoming. His continued interest in the Lower Cretaceous of Texas led to a paper on that subject. In 1899 he contributed a description of the Jurassic and Cretaceous faunas to the Survey's monograph on the geology of Yellowstone National Park. The formations around the mouth of the Judith River in central Montana had been generally assigned to the Laramie assemblage. In 1903, with the vertebrate paleontologist J. B. Hatcher, Dr. Stanton showed for the first time that the Judith River formation was far below any beds that could be considered Laramie, and there has been no doubt about it since. In 1905 he described the invertebrate fauna of the Judith River formation. When Alpheus Hyatt died in 1902, he left an important work on Cretaceous ammonites in an unfinished state, and Stanton arranged and edited the material to make it available, an undertaking that involved much effort and very good judgment. During the succeeding years he wrote many smaller papers describing faunas and local stratigraphy presenting interpretations of geologic history. His two major faunal papers in this period were the description in 1920 of the larger fauna of what is now called the Cannonball formation and in 1947 of some of the pelecypods and gastropods of the Comanche series.

Stanton was a conspicuous figure in the protracted and sometimes acrimonious debates over the "Laramie problem" and over the age assignment of the Morrison formation. The Laramie problem involved the questions of whether all the nonmarine deposits originally called Laramie belong to one time period and, if one, whether this time period was to be considered all Tertiary or all Cretaceous. There were vigorous supporters of each of an array of answers. Specialist opinion today has pretty well settled upon a view that completely supports none of the debaters, although Dr. Stanton's views were much nearer that of today than most of his contemporaries. His view on the age of the Morrison, that it is Jurassic and not Cretaceous, is accepted today.

Dr. Stanton's work brought him membership in a number of professional societies. In 1921 he was vice-president of the Geological Society of America and president of the Paleontological Society.

He was devoted to his family and found great pleasure in his daughters and grandchildren. He was a lifelong churchman, having been a member of a near-by church everywhere he went. He joined Hamline Methodist Church, in Washington, D. C., in 1900 and was active in its affairs until the last decade of his life.

Stanton's career overlapped the closing years of the period when the "general" paleontologists of the exploratory surveys were still active and that of the present when no one individual can expect to know more than a small part of the general field. His work had to cover a wide range of stratigraphy and paleontology, although it fell mostly in the later Mesozoic. During his years as a stratigrapher and paleontologist Stanton had to visit many field parties of the Geological Survey; his visits were always welcomed. In the office he had many contacts with geologists through conferences and particularly through his position as chairman of the Committee on Geologic Names; he was widely known for the soundness and fairness of his judgments. He was reserved and slow to adopt an idea, but tenacious of it and vigorous in defending it, once it was adopted; yet he never hesitated to change when a good reason was presented to him. His record of publication is one to stir pride, but his service to geology in the many unrecorded acts of such a lifetime as his may actually exceed it in value. His influence on American geology will last long.

News and Notes

75th Anniversary of the U.S. Geological Survey

Science is happy to participate in the celebration of the 75th anniversary of the U.S. Geological Survey through the publication in this issue, on page 3A, of a guest editorial by the director of the Survey and, under "Communications," of 10 digests of completed manuscripts reporting the results of current research. The Survey's work obviously embraces a wide spectrum of sciences. Additional digests will appear in subsequent issues; and scheduled for May 28 is a composite article, "The U.S. Geological Survey, 75 years of service to the Nation."

Through the years many Survey members have been active in the affairs of the AAAS. The AAAS actually evolved out of "The Association of American Geologists" as the result of a reorganization plan proposed by that society in 1847 and put into effect the next year. Geology has been represented by more AAAS presidents, 18 out of 107, than has any other science. Indeed, the first two presidents, William B. Rogers and William C. Redfield, were geologists.

The Electron Microscope Society of America

THE 11th Annual Meeting of this Society was held at Pocono Manor Inn, Pennsylvania, Nov. 5–7, 1953, and established records with over 300 electron microscopists registering for a program that included 78 technical papers and a six-paper symposium on electron microscopy of solids. There were international participants from Australia, New Zealand, Canada, England, Austria, France, Italy, Sweden, Japan, Argentina, and Uruguay. Summaries were heard from W. Bernhard of the Institut de Recherches sur le Cancer Gustave-Roussy (Villejuif, Paris), F. S. Sjöstrand of the Department of Anatomy, Karolinska Institutet (Stockholm), E. De Robertis of the Instituto de Investigaciones de Ciencias Biologicas (Montevideo), H. Braunsteiner of the University of Vienna (now at The Memorial Center, New York), and G. Yasuzumi of the Medical School of Osaka University.

In keeping with past programs, about 70 percent of the papers concerned applied electron microscopy, 15 percent instrumentation, and 15 percent techniques. Maintaining a departure first seen last year, there were about five times as many papers on biological as on nonbiological applications; before 1952 this ratio was always near two. Expanding biological applications, correlating and functional studies, a high degree of technical excellence, especially in work with thin sections, and informal discussion marked the meeting.

The program opened with a report on the 1953 meeting of the Deutsche Gesellschaft für Elektronenmikroskopie, including word of a record resolution of 6A. Papers on *instrumentation* included two in emission microscopy, three on new ultramicrotomes, and several on electron diffraction and details of electron and x-ray microscopes. Another session treated *techniques*, with papers on compressed protein films as specimen supports, shadow casting with collimation, and the preparation of biological specimens.

Physical and chemical applications (11 papers) included descriptions of metal and paint films, studies of the oxidation of single crystals of pure iron and of the decomposition of specimens, cotton fiber structure, cellulose acetate yarn abrasion, clays, and recent applications of the x-ray microscope. Subcommittee 11 of the Committee for Metallography of the A.S.T.M. met Nov. 4 to consider the electron microstructure of steel.

Work on *viruses* and on *particles associated with cancer* included morphological and developmental studies of a mycobacteriophage and of the following viruses: meningopneumonitis, herpes simplex, poliomyelitis, tobacco mosaic, and chicken leukosis. Conflicting reports of detection of the milk agent in mammary tissues and tumors of mice were heard, and a virus-like particulate from the plasma of leukemic mice was reported. French work on the detection of the virus in Rous sarcoma cells, the filamentous structure of nucleoli, and the basophilic cytoplasmic material was also discussed.

Excellent sections also delineated *cytoplasmic structures* and an 80–300 A particle that may correspond to material described in microsomal isolates and by cytochemists. Work on the *nucleus* included studies of fibrils of purified nucleic acid, descriptions of Japanese chromosomal studies, and a report of failure to verify regular helical structures in isolated human chromosomes. A group of five papers on *muscle* included histological works and fine details of filamentous organization. Another 5 papers dealt with *nerve*, the filamentous organization of the axon, lipids in the nerve sheath, synapses, and neuromotor structures of a protozoan.

Some *clinical applications* were summarized, with mention of functional studies and of some contributions of the electron microscope to diagnosis and to clinical pathology. Lengths of isolated human chromosomes from normal and cancerous subjects were reported as statistically different in some cases. *Cell division*, treated in detail in four reports, included consideration of the cell center and of other cytoplasmic structures during mitosis, as well as initial reports of details of division and structure of bacterial cells. Many other *cells and tissues* were represented in the closing set of eleven papers that included evidence suggesting a submicroscopic mechanism for active transport through the wall of blood capillaries.

Several of the papers were presented as demonstrations, augmenting the outstanding exhibitions of micrographs and of commercial equipment. These included several commercial ultramicrotomes, and a demonstration of the new Bibliography of Electron

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Microscopy presented by the New York Society of Electron Microscopists, using prepunched Keysort cards.

The abstracts of this meeting appeared in the *Journal of Applied Physics* **24**, 1414 (1953). R. G. Picard, Radio Corporation of America, Camden, N. J., is president of the Society; C. E. Hall, Biology Department, MIT, Cambridge, Mass., past president; and Jeannette R. Cooper, General Electric Co., Cleveland 12, Ohio, the secretary. The program chairman for 1954, C. F. Tufts of Sylvania Electric Products, Inc., Bayside, L. I., N. Y., would welcome suggestions and communications from interested persons.

A. R. T. DENUES

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Third International Conference on Soil Mechanics and Foundation Engineering

THE Third International Conference on Soil Mechanics and Foundation Engineering was held, under the chairmanship of Professor K. Terzaghi of Harvard University, U.S.A., at Zurich and Lausanne Aug. 15–27, 1953. Seven hundred members attended with thirty-eight countries represented. The best represented countries were U.S.A., Great Britain, France, and, of course, Switzerland.

Two preliminary volumes of the Proceedings had been published previous to the Conference. They contain the 154 papers submitted by authors, and 8 reports by the general reporters of each study section. These papers provided the basis for the discussion which took place in eight sessions.

The discussion treated the eight following topics: Theories and hypotheses of general character, soil properties, classification, engineering geology; Laboratory investigation (including compaction tests, improvement of soil properties); Field investigation, technic of field observations, including compaction control and soil stabilization; Foundations of buildings and dams, bearing capacity, settlement observations, regional subsidences; Piles and pile foundations, settlements of pile foundations; Roads, runways, airports (flexible and rigid pavements and their foundation); Earth pressure, retaining walls, tunnels and pits in soils; Stability and deformation of slopes and earth dams, research on pore pressure-measurements, groundwater problems.

A general lecture was delivered at the beginning of each session. In accordance with the practice introduced at the Second International Conference in Rotterdam, these lectures, with the exception of Professor Terzaghi's "Fifty Years of Subsoil Exploration," were devoted to research and practical problems of the guest land. Therefore, Professor R. Haefeli treated the subject of "Creep Problems in Soil, Snow, and Ice," Dr. A. von Moos lectured on "The Subsoil of Switzerland," Dr. J. Killer on "Foundations for High Tension Towers," Mr. G. Gysel on "Geotechnical Experiences Gained During the Construction of the Hydroelectric Plants of Loentsch, Etzel, Rupperswil-Auenstein and Wildegg-Brugg," Dr. R. Ruckli on "Geotechnical Applications in Road Construction in Switzerland," Dr. W. Eggenberger on "The Project of the Göschenenalp Dam, Switzerland," and Professor E. Meyer-Peter on "Soil Mechanics and Foundations of the Marmorera Dam, Switzerland."

At the closing session at Lausanne, Mr. Peltier (Paris) delivered a lecture on "Geotechnical Considerations on the Bearing Capacity of Roads" and Professor A. Stucky (Lausanne) gave one on "Problems in the Foundation of Large Dams."

A four-day tour had been arranged in the interval between the Zurich and the Lausanne sessions. The first day of this excursion was devoted to a visit to the earth dam of Marmorera in the canton of Grisons; another group visited the Swiss Federal Institute for Snow and Avalanche Research at Weissfluhjoch near Davos. The next day members traveled through the valley of the Engadine, the Bergell, and along the Lake of Como to Lugano. On the third day members viewed the new Alpine road of Susten and the Grimsel hydroelectric plant in the canton of Berne. On the last day they went to Lausanne through the Loetschberg tunnel and the Rhone valley.

After the closing session many members took part in two excursions to two dam sites under construction, both located high in the mountains, the Mauvoisin Dam (height : 237 m) and the Grande Dixence Dam (height : 281 m).

The Executive Committee of the International Society assembled in four meetings in which amendments of the statutes were discussed and 5 vice presidents were elected, one for each continent: Professor A. W. Skempton for Europe, Professor K. Hoshino for Asia, Professor W. S. Hanna for Africa, Mr. A. E. Cummings for North America, and Professor M. Vargas for South America. Mr. A. Banister (London) was elected general secretary of the International Society since Professor D. W. Taylor wished to resign this office. It was decided that the Fourth Conference would be held in London.

The unabridged text of the discussion for each section, the lectures, and the minutes of the executive committee meetings will appear in the final volume of the Proceedings. The *Proceedings* (3 vols.) have been edited by the Swiss Secretariate, Gloriastrasse 39, Zurich.

A. VON MOOS

Troisième Congrès International de Méchanique des Sols et des Travaux de Fondations Suisse 1953

Science News

Last spring E. Willard Berry, chairman of the Duke University geology department, was asked by the Diamond Corporation of Angola, Portuguese West Africa, to collect and analyze samples of rock in order to discover new localities where **diamond mining** might be profitably conducted. Dr. Berry flew to Angola in May and, from headquarters in the com-

pany settlement at Dundo, some 350 mi from the coast, drove each day into surrounding territory to obtain samples ranging from gravel and volcanic ground to bedrock. Diamonds are usually found in kimberlite, a course-grained volcanic material that took its name from the Kimberly diamond mines in the Union of South Africa.

Twelve large boxes of African rocks are now being shipped to Duke University. These specimens, which average approximately 1½ lb in weight, probably do not contain diamonds, but are useful as "yardsticks" for estimating the probable diamond producing capacity of the locality from which a particular sample was taken. The rocks will be studied by mineral analytical procedures, which include microscopic examination, viewing by polarized light, and determination of mechanical properties such as weight, texture, and specific gravity.

Fossils throwing new light on man's knowledge of the evolutionary distribution of mammals on two of the earth's continents have been unearthed at an excavation site in the McKay Reservoir by the University of Oregon Museum of Natural History. The fossils confirm relationships between mammals of North China and other areas of Asia and those of North America. More than 3000 specimens, many of them similar or related to mammals of the Pliocene epoch found in North China, have been uncovered at the site, located south of Pendleton.

University teams, led by J. A. Shotwell, curator of the Museum, have unearthed a sabre-tooth cat, older than the Rancho La Brea cats found in California. Fossils of an early horse, wolverine, and a beaver not related to the present-day animal also have been uncovered. The beaver fossil indicates that the life of this period migrated both ways on the two continents.

Fossils of primitive plants nearly two billion years old, the oldest yet uncovered, have been discovered on the northern shore of Lake Superior. Announcement of the find was made by Elso S. Barghoorn, associate professor of botany at Harvard University, and Stanley A. Tyler, head of the Department of Geology at the University of Wisconsin. The age of the specimens was based on calculations made by Patrick Hurley, executive officer of the Department of Geology and Geophysics at the Massachusetts Institute of Technology.

The fossils are described as both blue-green algae and simple forms of fungi, "the oldest structurally preserved organisms which have been discovered in pre-Cambrian sediments." They were imbedded in a deposit of flint rock taken from the Gunflint Iron Formation near Schreiber, Ont. For the past two years Dr. Tyler and Dr. Barghoorn have worked together in field excavations and laboratory research to unearth and identify the primitive lower plants.

Moderate quantities of **magnetite** have been found on several Puerto Rican beaches by members of the U.S. Geological Survey working in cooperation with the Puerto Rico Economic Development Administration. The discovery suggests the possibility of adding a new industry to the Commonwealth's economy by recovering the iron by means of a magnetic process similar to that employed in other parts of the world, notably in Misawa, Japan. Although the iron-bearing sands had previously been reported, the location and extent of the more promising areas had not been determined. The final results of this investigation will be published in detail at a later date by the Geological Survey.

New light has been thrown upon the manner in which nature deposits **mercury ores.** Frank Dickson and George Tunnel, geologists at the University of California at Los Angeles, have established that cinnabar (mercuric sulfide), chief mineral source of mercury, is precipitated when solutions containing mercury sulfide and sodium sulfide are neutralized or diluted with water. Evaporation actually increases the amount of dissolved cinnabar, although continued evaporation eventually precipitates the mercury; however, this was not in the form of cinnabar but in that of an easily redissolved double salt.

This work is the first to establish definitely the precipitation curve of cinnabar at a fixed temperature. The U.C.L.A. study is one step in a series tracing the course of mercury compounds in naturally-occurring solutions to their final ore deposit form. The study is being made under a contract with the Office of Naval Research.

A new mineral, probably one of the rarest in the earth's crust, has been discovered and described by George Switzer, geologist at the Smithsonian Institution. Named **ordonezite** in honor of a Mexican geologist, the late Ezequiel Ordonez, the mineral was found in a Mexican tin mine. It is a combination of zinc, antimony, and oxygen in the form of tiny glassy-brown crystals. Dr. Switzer has obtained approximately ¼ lb in its pure state.

The rediscovery of an even rarer mineral, **mosesite,** has made its analysis possible for the first time. William F. Foshag, head curator of geology at the Smithsonian, has found that mosesite is a combination of mercury, nitrogen, chlorine, and water. Mosesite was first discovered in Texas about 40 yr ago, but the quantity was so small that geologists could not analyze the sample. Dr. Foshag said that the combination of elements in mosesite has never been found in mineral form before. Further, the nitrogen molecule is an ion hooked to mercury in a bond unique in nature.

Discovery of one of the largest and richest camp sites of **prehistoric man** ever recorded in Western Europe was reported recently by Hallam L. Movius, Jr., associate professor of anthropology at Harvard University. He placed the site in the Upper Palaeolithic era dating back 18,000 to 25,000 yr. The location is a rockshelter, Abri Pataud, in the village of Les Eyzies in south central France. It was uncovered

in the summer of 1953. Preliminary excavations revealed a very large series of flint artifacts and, more importantly, "better preserved and more complete mammalian material than has been recovered from any other Upper Palaeolithic site in Western Europe in recent years."

The mammalian finds indicate that the horse was one of the chief foods of the hunter bands in the Aurignacian period 25,000 yr ago. Some 7000 yr later —as examination of the Upper Perigordian levels showed—the horse had evidently disappeared from the scene and had been supplanted by the reindeer as a chief meat source.

Prof. Movius estimated that 5 to 6 yr will be needed to complete the excavation survey. Financial support of the investigations which led to the discovery of the Abri Pataud site has been through the George Grant MacCurdy Fund of the Peabody Museum at Harvard.

Soil bacteria can be used as a tool to locate oil deposits. Raymond J. Strawinski, a bacteriologist at Louisiana State University, has patented a method of determining the presence of gas in the soil by examining microorganisms. Primary advantages of the method are its simplicity, lack of expense, and the quickness with which the test can be completed. Geologists have long supposed that the gas found with underground oil seeps through the earth to the surface in small amounts. Dr. Strawinski reasoned that bacteria in the soil might feed on this gas, and his experience has confirmed that oil is in the immediate vicinity of hydrocarbon-consuming organisms.

Scientists in the News

Loyal V. Bewley, head of the Electrical Engineering Department at Lehigh University, has been made dean of the College of Engineering.

At the 136th annual meeting of the New York Academy of Science three distinguished scientists were elected to honorary life membership: **Adolph Friederich Johann Butenandt,** Kaiser Wilhelm Institute of Physiological Chemistry, Germany; **Christopher Keokingold,** Director of Chemistry Laboratories, University of London; and **A. R. Radcliff-Brown,** founder of the British School of Social Anthropology and professor emeritus of Oxford University.

Edward A. Chapin, since 1934 curator of insects at the U.S. National Museum, Smithsonian Institution, has retired after nearly 37 years in government service. Dr. Chapin began his government career in 1917 in the U.S. Department of Agriculture, where he served successfully under three agencies: the Bureau of Biological Survey, the Bureau of Animal Industry, and the Bureau of Entomology. Dr. Chapin is one of the country's leading specialists in the *Coleoptera,* and is the author of numerous scientific papers on this important insect order. He and his wife will make their home at West Medway, Mass.

G. Robert Coatney, head of the Chemotherapy Section of the Laboratory of Tropical Diseases, National Institutes of Health, has been named winner of the Darling Medal and Prize given by the World Health Organization for outstanding work in the field of malaria research.

Dudley D. Fuller has been appointed principal scientist in the Division of Laboratories, The Franklin Institute, where he will be in charge of the Friction and Lubrication Section. Mr. Fuller will continue on the staff at Columbia University as an associate professor of mechanical engineering.

William Walter Greulich, science adviser to the United States High Commissioner for Germany, has been appointed chairman of the United States Educational Commission in the Federal Republic of Germany. Dr. Greulich is on leave of absence from Stanford University, where he is a professor of anatomy in the School of Medicine.

Douglas Guthrie, distinguished medical historian of the University of Edinburgh, will visit medical centers in the United States during March, following a tour of Australia and New Zealand. He spoke at the University of California at Los Angeles the latter part of February, and will give an address at the University of Texas Medical Branch, Galveston, Mar. 19 on "The pursuit of the infinitely small" dealing with the history of the microscope. He will also give a special lecture on "Ancient drugs and herbals". Following his visit at the University of Texas Medical Branch, he will deliver the Logan Clendening Lectures at the University of Kansas, Lawrence and Kansas City, Mar. 29, 30, 31.

Lewis W. Hackett, visiting professor of public health at the University of California, Berkeley, and editor of the *American Journal of Tropical Medicine and Hygiene,* has been awarded the Walter Reed Medal for meritorious achievement in tropical medicine. Dr. Hackett, who has done outstanding work on malarial epidemiology, received the medal from the American Society of Tropical Medicine and Hygiene.

Eleanor A. Hall has been named to the newly-created post of assistant dean of the Yale School of Nursing, where she is an associate professor.

The 1953 Southwest Award of the American Chemical Society has been won by **Henry Rudolf Henze,** professor of pharmaceutical chemistry in the University of Texas. Prof. Henze, former head of the Department of Chemistry of the University of Texas in Austin and former chemistry chairman of the University's medical branch in Galveston, was cited both for his contributions to experimental chemistry and for his role as an outstanding educator.

Robert B. Hobbs, for some 20 years a staff member of the Organic and Fibrous Materials Division of the National Bureau of Standards, has been appointed chief of the Paper Section.

Clarence Lester Hogan, formerly of the Bell Telephone Laboratories, has been appointed associate professor of applied physics in the Division of Applied Sciences at Harvard University. Dr. Hogan is noted for his successful construction of the microwave gyrator, the first practical circuit element that violates the so-called theorem of reciprocity. As a result, it is now possible to transmit power in one direction through a microwave circuit without interference from reflected waves and without the necessity of matching impedances. In principle this element permits the simultaneous transmission and reception of a single frequency from the same antenna.

Arthur Knudson, chairman of the Department of Biochemistry at Albany Medical College, has returned to his post after two years in Thailand. Prof. Knudson's assignment was a part of the Mutual Security Administration's (now the Foreign Operations Administration) program. He taught biochemistry in Bangkok's 65-year-old Siriraj Medical School and Hospital and in the 7-year-old Chulalongkorn Medical School, both under the Thailand Ministry of Public Health. He also was instrumental in the establishment of an experimental nutritional laboratory. There are approximately 1600 to 1700 physicians in Thailand, a nation of eighteen million; this means one physician to every 10,000 persons, as compared with one per thousand in the United States.

Harrison S. Martland, noted pathologist and pioneer in the diagnosis of radioactive diseases, has resigned as chief medical examiner of Essex County, N.J., after 28 years in office. He will continue as consultant to the new chief, **Edwin G. Albano.** Dr. Martland's numerous papers on diseases from radioactive products have been issued in book form by the Atomic Energy Commission.

Harold L. Mitchell, director of the Southern Forest Experiment Station in New Orleans, has been appointed chief of the Division of Silvicultural Relations at the U.S. Forest Products Laboratory in Madison, Wis. The Laboratory is a research unit of the Forest Service, U.S. Department of Agriculture.

At its autumn meeting, the National Academy of Sciences voted to award the Daniel Giraud Elliot Medal for the year 1950 to **Raymond Carroll Osburn** of the Hancock Foundation, University of Southern California. The medal is given annually in recognition of meritorious accomplishment in zoology or paleontology, and Dr. Osburn is being honored for his work entitled *Bryozoa of the Pacific Coast of America Part I, Cheilostomata-Anasca.* Presentation of the medal and accompanying honorarium will be made in Washington at the 91st annual meeting of the Academy in April.

Wesley T. Pommerenke, associate professor of obstetrics and gynecology at the University of Rochester School of Medicine and Dentistry, is spending a sabbatical year working under the auspices of the Unitarian Service Committee. Having given several lectures at the American University in Beirut, at the end of January Dr. Pommerenke proceeded to the Medical School of the University of Madras, India, where he will stay for three months as a visiting professor. He will spend another three months at the Medical School of Keio University in Japan.

Charles G. Wilder, formerly director of the Kansas City Museum Association, has been named chairman of the Exhibits Division of the Oak Ridge Institute of Nuclear Studies. His new responsibilities include the American Museum of Atomic Energy and the extensive traveling exhibit program of the Institute. Mr. Wilder replaces **David L. DeJarnette,** who resigned on Oct. 1 to become archeologist-in-charge for Mound State Monument in Alabama.

New additions to the faculty of Lebanon Valley College, Annville, Pa., are **Francis H. Wilson,** formerly head of the Biology Department at Champlain College (N.Y.), who has been named professor of biology; and **Barnard H. Bissinger,** previously of Michigan State College, who has been appointed associate professor and head of the Department of Mathematics.

Education

The University of Maryland announces the offerings of the **Institute of Acarology for the Summer Session,** 1954, from June 21 to July 10. Since the inception of this program at Duke University in 1951, it has provided a unique opportunity for entomologists, parasitologists, and zoologists to learn about mites and ticks. In line with the recent important discoveries of the role of the Acarina in the fields of public health and agriculture, the program now has been expanded to be of greater service by increasing the facilities, the staff, and by the participation of investigators from nearby institutions. The staff this year consists of Edward W. Baker, U. S. Department of Agriculture; Joseph H. Camin, Chicago Academy of Sciences; R. W. Strandtmann, Texas Technological College; and George Anastos, Flora Gorirossi, and G. W. Wharton, of the University of Maryland. Further information can be obtained from G. W. Wharton, Department of Zoology, University of Maryland, College Park, Md.

Establishment of a **Law-Medicine Center** to help improve the administration of justice through more effective use of medical science has been announced by Western Reserve University and the coroner's office of Cuyahoga County. In addition to Western Reserve's law school and the county coroner's laboratory, facilities available for the Law-Medicine Center will include those of the Western Reserve School of Medicine, Institute of Pathology, and science departments, and the resources of Case Institute of Technology. The importance of the relation of medicine to law is demonstrated by the fact that two of every three cases which

reach the Ohio appellate courts involve a medical issue.

Franz Moewus, Privatdozent, University of Heidelberg, and currently research associate in the Department of Zoology, Columbia University, will be a member of the staff of the summer course in marine botany (phycology) at the **Marine Biological Laboratory, Woods Hole.** Harold C. Bold of Vanderbilt University, Richard C. Starr of Indiana University, and Ruth Patrick of the Academy of Natural Sciences, Philadelphia, are also members of the instructional staff. The course is scheduled to run from June 15 through July 24.

In addition, Hewson Swift of the University of Chicago, for many years director of the Laboratory, has been appointed to the Frank R. Lillie Memorial Fellowship for this next summer.

Grants and Fellowships

The Scripps Metabolic Clinic has established a postdoctoral fellowship to be known as the **Charles Willard Stimson Fellowship in Biochemistry.** It will be available on a yearly basis to investigators interested in intermediary metabolism, particularly carbohydrate and fat metabolism. The stipend is $5000 per year. Those interested should send applications to The Scripps Metabolic Clinic, La Jolla, Calif.

A **$2500 fellowship in chemical engineering** has been established at Tulane University by the Dow Company of Midland, Mich. It will be available to a graduate student who will be selected by the faculty of the Department of Chemical Engineering. Establishment of the fellowship is part of the Dow Company's program to promote scholarship in chemistry and chemical engineering in colleges and universities throughout the United States.

Nominations are invited for the third **Kimble Methodology Research Award,** which will be presented in October through the generosity of the Kimble Glassware Division of Owens-Illinois Co. The award, consisting of $500 and a suitably inscribed plaque, is administered by committees of the Conference of State and Provincial Public Health Laboratory Directors. For detailed information and nomination blanks write Alfred S. Lazarus, School of Medicine, University of Washington, Seattle 5, Wash.

The **Rockefeller Foundation** listed the following scientific grants in the report for the fourth quarter of 1953:

California Institute of Technology. Continuation of long-term aid to experimental biology, $1,500,000.

Food Research Institute, Stanford University. Contribution of support to basic research in food production, distribution, and consumption, $500,000.

Cornell University Medical College. V. du Vigneaud, Dept. of Biochemistry. Biochemical research concerned with the sulphur-containing amino acids, polypeptides, and hormones, 7 yr, $150,000.

University of Wisconsin. Research in biochemistry, $200,000.

University of São Paulo, Brazil. Faculty of Philosophy, Sciences, and Letters. Experimental biology, 3 yr, $45,000.

University of São Paulo. Faculty of Veterinary Medicine. Animal climatology, 3 yr, $30,000.

University of São Paulo. Faculty of Medicine at Riberirão Preto. Research in biochemistry, histology, embryology, and parasitology, 3 yr, $50,000.

University of Rio Grande do Sul, Brazil. Faculty of Philosophy. Equipment for research in genetics, botany, and paleontology, 3 yr, $50,000.

University of Rio Grande do Sul. School of Agronomy and Veterinary Medicine. Equipment and library materials, 2 yr, $25,000.

Virus research stations in Trinidad, South Africa, India, and Egypt. Continuation of Foundation virus research program, $300,000.

Agriculture program of Government of Mexico and the Foundation. Continuation of support of research and training, $175,750.

Mexican food production program. Research and training, $100,000.

Colombian agricultural improvement program. Research and training, $140,000.

Central American Corn Improvement Program. Establishment of program and technical assistance, $30,000.

Tennessee Department of Public Health. Tuberculosis study in Williamson County, $21,000.

Stanford University. E. L. Tatum. Survey of European trends in microbiology, genetics, and biochemistry, $2300.

University of Hawaii. Equipment for research in marine biology, $10,000.

University of Hawaii. Three-month examination by agricultural scientist of program of College of Agriculture, $3000.

University of California. N. T. Mirov, Forest Experiment Station. Research, $7300.

University of California. W. C. Snyder, Dept. of Plant Pathology. Visit to European research centers, $5000.

University of Illinois. Neuropsychiatric Institute. Purchase of portable x-ray unit, $4000.

Vanderbilt University, Dept. of Pediatrics. Exchange of senior assistants with Karolinska Institute, Stockholm, 3 yr, $3000.

University of Pittsburgh. H. S. Belding, Graduate School of Public Health. Visit to European centers of environmental physiology, $2300.

Tufts College. C. C. Roys, Dept. of Biology. Year's stay at Univ. of São Paulo, $2100.

American Psychological Association. Planning of conference on the evolution of behavior, $1000.

Cornell University. F. S. Anthony, Dept. of Agronomy. Visit to agricultural research centers in U.S., $500.

University of Bristol, England. J. M. Yoffey, Dept. of Anatomy. Experimental histology and physiology, $6200.

University of Leeds, England. F. S. Dainton, Dept. of Chemistry. Radiation chemistry, $5000.

University of Cambridge, England. M. Perutz. X-ray crystallography of proteins, $4000.

University of Oxford, England. E. K. Woodford, Dept. of Agriculture. Ninety-day visit to agricultural research centers in U.S., $2500.

St. Bartholomew's Hospital Medical School, England. H. Lehmann, Dept. of Pathology. Visit to sicklemia research centers in U.S. and Canada, $2505.

Ministry of Labor and National Service, England. J. H. F. Smith, Factory Dept. Visit to industrial hygiene departments in the U.S., $2350.

Ministry of Labor and National Service, England. R. Murray, Factory Dept. Visit to occupational health and industrial hygiene centers in U.S. and Canada, $2350.

University College, England. Dept. of Botany. Research in plant physiology, $3000.

Ministry of Works, England. G. L. Ackers. Visit to centers of public health engineering in U.S. and Canada, $2150.

University of London, England. A. V. Hill. Attendance at scientific conferences and visits to biophysical research centers in U.S., $2100.

University of Oxford, England. D. D. Woods, Dept. of Microbiology. Equipment, $1800.

Institute of Biology, London. Travel expenses of American delegate to symposium, $700.

Collège de France, Paris. J. Roche. Research in biochemistry, 2 yr, $15,000.

University of Marseilles. Laboratory of Biological Chemistry. Equipment, $6000.

University of Bordeaux, France. R. Castaing, Laboratory of Cardiology. Equipment, $1200.

Health Authority of Hamburg, Germany. H. Harmsen, Academy of Public Health. Teaching program, 5 yr, $35,000.

University of Athens, Greece. L. Zervas. Research in biochemistry, $3000.

University of Rome, Italy. A. Rossi-Fanelli, Institute of Biological Chemistry. Research in biochemistry, $7500.

University of Padua, Italy. U. D'Ancona, Institute of Zoology and Comparative Anatomy. Equipment, $5000.

State University of Utrecht, Netherlands. J. B. Thomas, Biophysics Research Group. Visit to U.S., $2350.

University of Wageningen, Netherlands. C. J. P. Spruit, Dept. of Plant Pathology. Extension of visit to U.S., $1200.

University of Geneva, Switzerland. F. Chodat, Institute of General Botany. Research in plant biochemistry, $2000.

University of Zurich, Switzerland. M. Viscontini. Institute of Chemistry. Visit to enzyme chemistry research centers in England, $700.

University of Geneva, Switzerland. B. Inhelder, Institut des Sciences de l'Education. Visit to child psychology research centers in U.S. and Canada, $2550.

University of Alexandria, Egypt. M. A. Abbasy. Faculty of Medicine. Visit to preventive medicine centers in England, Puerto Rico, Canada, and U.S., $2900.

Virus Research Institute, Entebbe, Uganda. P. J. Mason. Visit to virus research centers in U.S., $2200.

University College, Nigeria, West Africa. Equipment and expenses for field visits, $10,000.

King George's Medical College, Lucknow, India. Equipment for Pharmacology Department, 3 yr, $7500.

Trivandrum School of Nursing, India. L. A. Johnson. Equipment, $7500.

Medical College, Indore, India. R. P. Singh, Anatomy Dept. Equipment, $5000.

University of Bombay, India. A. Sreenivasan, Dept. of Chemical Technology. Equipment for research in biochemistry, $5400.

Indian Institute of Science, Bangalore, India. J. Ganguly. Equipment for research in biochemistry, $5600.

Government General Hospital, Madras, India. B. Ramamurthi. Neurosurgery Unit. Equipment, $2000.

Indian Cancer Research Center, K. J. Ranadive, Tissue Culture Laboratory. Equipment, $2300.

Indian Council of Medical Research, Coonoor, South India. C. Gopalan, Nutrition Research Institute. Visit to nutrition research centers in U.S. and Canada, $950.

Indian Council of Medical Research, B. K. Anand, Lady Hardinge Medical College, Delhi. Equipment, $950.

University of Adelaide, South Australia. P. M. Nossal. Equipment for research in biochemistry, $3000.

Tokugawa Institute for Biological Research, Tokyo, Japan. H. Tamiya. Mass cultivation of microorganisms for human food, $25,000.

Nagoya University, Japan. T. Yamada, Biological Institute. Research in embryology, $10,000.

Japanese Red Cross Central Hospital School of Nursing. Teaching aids and equipment, $8200.

Japanese Nursing Association, Tokyo. Equipment and library supplies, $4685.

Ochanomizu University, Tokyo. K. Anno. Equipment for research in biochemistry, $3000.

Provincial Government of Taiwan, Taipeh, Formosa. Y. Ching, Dept. of Education. Visit to study school health work and health education in U.S., $4550.

University of Buenos Aires, Argentina. M. Reichard, Faculty of Agronomy and Veterinary Medicine. Visit to wind-eroded areas in U.S., $1125.

University of Minas Gerais, Brazil. J. B. Vianna, Dept. of Biochemistry, Faculty of Medicine. Equipment, $10,000.

Araraquara Rural Health Training Center, Brazil. Equipment, 2yr, $10,000.

University of Bahia, Brazil. J. Novis, Dept. of Physiology. Equipment, $9000.

Secretariat of Agriculture, Industry, and Commerce, Rio Grande do Sul, Brazil. Equipment for Dept. of Animal Production, $5000.

State Secretariat of Agriculture, Bahia, Brazil. F. J. Alice, Institute of Biology. Foot-and-mouth disease and other virus investigations, $4700.

Institute Agronómico, Campinas, Brazil. O. Bacchi. Equipment for the seed laboratory, $4500.

Rural University, Belo Horizonte, Brazil. J. F. Braga and L. M. Magalhaes. Visit to Latin American centers of agricultural education and research, $3800.

University of Brazil, Rio de Janeiro. H. Meyer, Institute of Biophysics. Study of electron microscopy in U.S., $1080.

University of São Paulo, Brazil. Institute of Oceanography. Equipment for development of marine resources, $9150.

University of São Paulo. P. Sawaya. Visit to Latin American centers of research on marine resources and experimental biology, $2650.

University of São Paulo. Equipment for use of the Second Pan-American Congress of Agronomy, $2000.

University of São Paulo. E. Malavolta, Escola Superior de Agricultura, Piricicaba. Equipment for research in plant nutrition, $2800.

University of São Paulo. H. Rothschild, Dept. of Histology and Embryology. Equipment for research in protein chemistry, $800.

University of São Paulo. J. S. Veiga, Faculty of Veterinary Medicine. Visit to animal climatology centers in U.S., $715.

Ministry of Agriculture, Santiago, Chile. Equipment for LaCruz Insectarium, $10,000.

Ministry of Agriculture, Santiago, Chile. I. Tagle, Institute of Veterinary Investigations. Livestock parasitology, $10,000.

Ministry of Agriculture, Santiago, Chile. I. Tagle, Institute of Veterinary Investigations. Visit to parasitology research centers in Latin America and the U.S., $2850.

Bacteriological Institute of Chile, Santiago, E. Gallardo. Equipment for research in poultry pathology, $7200.

University of Chile, Santiago. P. Yanez, Marine Biological Laboratory. Equipment for research on problems of marine resources, $10,000.

University of Chile, Santiago. D. Brncic, Institute of Biology. Population genetics, $5100.

University of Chile, Santiago. I. Matte, Psychiatric Institute. Visit to psychiatric centers in U.S. and Canada, $3312.

Rural Health and Nutrition Service, San Felipe, Chile. Equipment, $1000.

Colombian Agricultural Program Operating expenses of Maize Collection Center, Medellín, $7500.

Colombian Agricultural Program. International exchange of information, materials, and personnel, $5000.

Ministry of Agriculture, Bogotá, Colombia. A. Chary. Visit to agricultural education, research, and extension centers in the U.S., $2200.

Endemic Disease Control Service, Dominican Republic. Continuing grant, $2000.

Mexican Agricultural Program. Operating expenses of Maize Collection Center, Chapingo, $7500.

College of Agriculture "Antonio Narro," Saltillo, Mexico. L. M. Medina. Visit to Latin American agricultural, educational, and research centers, $2000.

University College of the West Indies, Jamaica. G. Bras, Dept. of Anatomy. Visit to departments of physiology and pathological anatomy in U.S., $1900.

In the Laboratories

The **American Can Company** has purchased land in Barrington, Ill., for a large laboratory for food and container research. The proposed one-story research center would house a staff of 107 scientific and technical personnel and more than 30 other employees. Special hot and cold rooms, where climatic conditions from the tropics to the arctic could be simulated, would permit the test storage of every type of product.

The **American Instrument Co.** of Silver Spring, Md., has erected a 40,000-ft^2 plant at Savage, Md. This brings to six the number of plants owned and operated by the company.

Acquisition of the **American Polymer Corporation** of Peabody, Mass., has been announced by the **Borden Company.** The move is in line with the Borden Chemical Division's policy of expansion in the field of basic chemicals. The acquisition includes American Polymer plants in Illiopolis, Ill., Montreal, Canada, and São Paulo, Brazil. All these plants produce resin emulsions and solutions of various types from a number of base

monomers. American Polymer does not produce end products, but sells to manufacturers of adhesives, textile chemicals, sizings, paints, and similar items.

The **Du Pont Company** has announced construction of a $3,000,000 laboratory in Wilmington to expand the present capacity of its Polychemicals Department to provide sales and engineering services to customers in the plastics and other industries. The laboratory will have the most modern equipment available for developing technical data on the use and processing of Polychemicals Department products. Its facilities for providing engineering services, especially in the plastics field, will be several times those of the present laboratory at Arlington, N.J., which the new building will replace.

Research to end the nation's serious surplus of animal fats that totaled 700,000,000 lb in 1952 is being sponsored by the U.S. Department of Agriculture and the Association of American Soap and Glycerine Producers. The Association has given the Department of Agriculture funds for two scientists to devote full time to research for new uses of animal and other agricultural fats. The work will be done at the **Eastern Regional Research Laboratory** in Philadelphia. The fat surplus is largely caused by an increased demand for meat and a drop in the quantity of soap produced, owing to the use of synthetic detergents. The consumption of fats is up only 11 percent since World War II, while production of meat and all fats has risen by 50 percent.

The research project will fit into government's program of finding new uses for agricultural fats. Markets for fats have already been developed in the manufacture of some plastics, hot-dip tinning processes, synthetic rubber production, and animal feeds. The new fellowships will employ a postdoctoral scientist and a graduate student to work as an assistant. Stipends will be approximately $6000 and $4000 for one year. The program will run for an indefinite period of time.

Tentative plans for the construction of a large electronics engineering and research laboratory in Wayland, Mass., have been announced by the **Raytheon Manufacturing Company,** Waltham, Mass.

Rhodia, Inc., of New York City has started operations at its new aromatic chemicals plant in Paterson, N.J.

Setting a precedent in commercial laboratory practice, **Truesdail Laboratories, Inc.,** Los Angeles, has established a research advisory board of well-known scientists. It will help guide procedures and evaluate results of research projects under way for the firm's clients. The advisory board consists of: Arie J. Haagen-Smit, California Institute of Technology; Clinton H. Thienes, Huntington Memorial Hospital, Pasadena; Arthur W. Adamson, University of Southern California; Don M. Yost, California Institute of Technology; and William G. Young, University of California at Los Angeles. The new arrangement is expected to be mutually advantageous. The board will have an opportunity to help tackle everyday industrial problems, and industry will receive the services of experts that it might not be able to have otherwise.

The **Waldemar Medical Research Foundation, Inc.,** has moved its laboratory from 16 Clinton St., Brooklyn to 16 Sintsink Drive East, Port Washington, N.Y.

Engineering and office personnel have moved into the new plant of the Westinghouse Atomic Equipment Department. Located in Harmar Township, Pa., the plant is part of the **Westinghouse Atomic Power Division** which is building the atomic submarine engine for the *U.S.S. Nautilus* and is developing the first civilian atomic power plant. This new plant will produce component parts and accessories for atomic power plants and represents an initial investment of $2,000,000 by the Westinghouse Electric Corporation.

Meetings and Elections

An **Advisory Committee in Physiological Psychology** to the Office of Naval Research has been organized as the fifth such committee under auspices of the American Institute of Biological Sciences. W. J. Brogden of the University of Wisconsin is chairman of this committee. Other members are: Clarence Graham, Columbia University; D. O. Hebb, McGill University; Wilden A. Munson, Bell Telephone Laboratories, Inc.; and Carl Pfaffmann, Brown University. The first meeting of the committee was held at the Harvard Psycho-Acoustic Laboratory, Cambridge, Mass., on Dec. 4–5, 1953. At present the Physiological Psychology Branch of ONR supervises 52 contracts at 32 universities in 21 states.

Officers of the **Association of Southeastern Biologists** are: pres., Bruce D. Reynolds, University of Virginia; v. pres., Alvin D. Beatty, Emory University; sec., Mary Esther Gaulden, Oak Ridge National Laboratory; treas., J. Paul Reynolds, Florida State University. The president-elect is H. R. Totten, University of North Carolina.

The International Committee on Group Psychotherapy has organized the **First International Congress on Group Psychotherapy,** to be held in Toronto, Canada, in connection with the Fifth International Congress on Mental Health next August. The conference will promote the exchange of information and intensify personal contact between workers in mental health and allied professions throughout the world. A series of meetings has been arranged. Papers and symposia will deal with group psychotherapy and group studies in the areas of family relations and the national and international communities.

Therapeutic work with children and parents, adolescents and the aged, addicts and delinquents will be presented. The use of groups in education, industry,

government, and with different ethnic groups are among the subjects for panel discussions. There will also be discussion groups dealing with various aspects of group psychotherapy and group studies during the week of Aug. 16.

Representatives of 23 nations are participating in the organization of the Congress. Wilfred C. Hulse and Welman J. Warner are chairmen, J. L. Moreno and S. R. Slavson are consulting chairmen. For full details write to International Congress on Group Psychotherapy, Room 916, 1790 Broadway, New York 19.

The 1954 National Telemetering Conference under the joint sponsorship of the Institute of Radio Engineers, the American Institute of Electrical Engineers, the Institute of the Aeronautical Sciences, and the Instrument Society of America will be held at the Hotel Morrison in Chicago, May 24–26. This year's meeting promises to provide subject matter of wider scope and deeper interest as a result of a considerable amount of missile telemetering and remote control information recently developed.

W. J. Mayo-Wells of the Applied Physics Laboratory of Johns Hopkins University is chairman of this year's meeting. Charles Doersam, formerly of the Office of Naval Research and now with Sperry is program chairman. Mr. Kipling Adams of the General Radio Company is in charge of local arrangements and serves as vice chairman.

The **Society of Exploration Geophysicists** has elected the following officers for 1954–55: pres., Paul L. Lyons, Anchor Petroleum Co., Tulsa, Okla.; v. pres., Roy F. Bennett, Sohio Petroleum Co., Oklahoma City, Okla.; sec.-treas., Hugh M. Thralls, Seismograph Service Corp., Tulsa, Okla.

A **Soil Microbiology Conference** will be held at Purdue University, June 21–24. It will be sponsored by The American Society of Agronomy, The Soil Science Society of America, and Purdue University. Reservations may be made direct through the Union Club, Purdue Memorial Union, West Lafayette, Ind. The 2½-day meeting will feature papers on the place of soil microbiology in soil science and the contributions that microbiology may make towards the solution of agronomic problems.

Representatives from more than fifty nations will attend the **Third International Gerontological Congress** to be held in London, July 19–23. Tentative plans call for the meeting to be divided into three sections: Biological, Clinical, and Sociological. Some of the problems to be considered in the biological section include nutrition, metabolism and aging, changes in the nervous system associated with aging, hormonal age changes and histological changes in endocrine organs with age, the effects of aging in the female generative organs, and degenerative vascular disease. Such subjects as arthritis and allied conditions, endocrinology and old age, neurological disorders, and surgery in the aged and aging patients will highlight the clinical section. The sociological section will be concerned with adult education and counselling, a critique of surveys, employment and personnel practices, recreation, housing, pensions and health insurance, and biometric studies of the population structure in the various countries.

According to recent information provided by the British Organizing Committee, the British Minister of Health will address the opening session of the Congress. Abstracts of papers to be presented are being received by Dr. Wm. B. Kountz, Chairman of the American Committee on Cooperation, 660 S. Kingshighway, St. Louis 10, Mo. Convoys, Ltd., has been named the official travel agent for the Congress and all Americans planning to attend are urged to make their reservations through Mrs. Viola Kelly, International Association of Gerontology, 660 S. Kingshighway, St. Louis 10, Mo.

Miscellaneous

The following **chemicals** are wanted by the Registry of Rare Chemicals, Armour Research Foundation of Illinois Institute of Technology, 35 W. 33 St., Chicago 16: tungsten hexacarbonyl; triethyl phosphine; mesoxalic acid hydrate; beta-chlorolactic acid; 3,3,3-trifluoro-1-propene; 2,5-dimethylfuran; dithiohydroquinone; n-dodecanesulfonic acid; neopentyl alcohol; 3-hydroxymethyl-2,4-pentanediol; tetrachlorohydroquinone diacetate; 2-nitro-4,5-dimethylaniline; 3-pyridinesulfonamide; glycidic acid; nathphalene-2,1-diazo-oxide; 9-decenoic acid; dimethyl diglycollate; disodium methylarsinate; stachyose; 3-hydroxykynurenine.

Continuous cores of more than 5700 feet of unmetamorphosed sedimentary strata from the George Vasen Fee Well No. 1, Stone County, Miss., the world's third deepest boring, are described in a recent Geological Survey circular. The Vasen test is situated less than 50 miles north of the Gulf of Mexico on the regional subsurface structure commonly called the Wiggins anticline. The test was started in 1946, and in 1951 drilling operations at the well were terminated in rock-salt at the total depth of 20,450 feet. The information obtained from the cores in the test well helps to clarify questions about the stratigraphy of the Jurassic rocks of the Gulf Coastal Plain and will aid future oil prospecting in the southern States. Copies of the report, which is published as Circular 298, **"The cored section in George Vasen's Fee Well No. 1, Stone County, Mississippi,"** by Paul L. Applin and Esther R. Applin, may be obtained without charge upon application to the Chief of Distribution, Geological Survey, Washington 25, D.C.

The Mellon Institute of Industrial Research has announced the availability, free, of Bibliographic Bulletin No. 7 entitled ***Zein: An Annotated Bibliography, 1891–1953,*** by Dorothy M. Rathmann. Requests for this publication should be addressed to the Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

Technical Papers

Preliminary Studies on the Use of a Specific Sound to Repel Starlings (*Sturnus vulgaris*) from Objectionable Roosts[1]

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Starlings, pigeons, and occasionally other birds may become pests by roosting in large numbers on buildings or in trees in residential areas. Many methods have been tried to rid infested premises (*1*), but none has proved generally satisfactory. We therefore instituted a study of the habits of the European starling, hoping to find better means to eliminate objectionable roosts.

Starlings were collected at night during the winter in barns near State College, Pa. When the birds were held by the legs or wings, they emitted a piercing shriek. This "distress call" caused other starlings to fly out of the barns immediately, even in the dark, and they did not return, even after some months.

This suggested that a recorded distress call might be used as a repellent. Accordingly, wild starlings were induced to give distress calls by holding their legs and shaking them roughly. The calls were recorded with a tape recorder (Pentron, Model 9T-3C). About 20 sec of the call of each bird were recorded and from these a continuous hour-long tape recording was made.

The first tests with this sound were made in State College, where the midsummer roost along one street for about ¼ mi and on adjacent side streets for about 50 yd was occupied by about 20,000 starlings. When the distress call was broadcast to the starlings in 4 trees in this area, with the loud speaker of the tape recorder, the trees were cleared in 2 nights. When delivered to birds in other trees through 2 speakers of a stationary public address system for 3 nights, 10 trees were cleared. These remained free of starlings, although the trees around them were heavily infested.

The sound was applied intermittently for about 30 min before and after sunset, as the birds came into the trees to roost. Whenever the trees were cleared, the sound was discontinued and resumed only when the birds tried to return. The object was to have the trees as free of birds as possible at nightfall. They thus remained nearly free of birds all night, because starlings do not ordinarily fly in the dark.

These successes induced us to try the repellent on a bigger scale. A distance of two blocks was chosen on the street with the main roost and one block on a street joining this. A sound truck with the tape recorder driving a 30-w amplifier and 2 horns was used and treatment was as before. Within 4 nights (Aug. 25–28) the treated areas was cleared and remained clear until a later experiment, even though many starlings were present all around.

We next tried to clear a whole town (Millheim, Pa., population about 1500) of its infesting starlings. There were 10,000–12,000 birds in 2 main roosting areas. Two sound trucks were used, and the operation was directed by an observer on a building. After 3 nights of treatment (Aug. 31–Sept. 2), starting as the first birds entered the trees and concluding at nightfall, fewer than 100 birds remained in town. These were harassed for 2 more nights, and the test was discontinued. These few starlings returned the night after the last treatment, but not the following night. The town remained free of starlings until the birds left the area for the winter, about Oct. 20. Usually this town is infested until then.

We next attempted in State College to clear the roosting area in which 3 blocks had previously been treated. With only one sound truck, this whole area was cleared in 4 nights (Sept. 5, 7–9) and remained so until fall migration, about Oct. 20.

The clearance of all State College, an area of approximately 3 square miles with many trees, was attempted later (Sept. 28–30), with 2 sound trucks. At this time, there were 10,000–12,000 starlings in 2 major roosts and 2 minor roosts. Treatment was as before—one truck gave particular attention to the major roosts and the second truck to the minor roosts and the roosts which started as the birds were driven from other places. After 3 nights of treatment, about 1½ hr each night with the sound applied about 75 percent of the time, only about 200 starlings remained in this large area in 3 isolated roosts, no longer pests. This town likewise remained clear until fall migration.

The distress call is distinctly sonic; in fact, our sound equipment does not handle over 10,000 cy/sec. The intensity at which it must be broadcast on the ground to penetrate a leafy canopy is rather high, about 120 db at 1 m from the horns. When the tape recorder alone is used, however, as in the first tests against birds more than 10 m away, the peak-free field sound pressure at that distance is only about 85 db. It is disturbing to man if heard near the horns, but is not troublesome when directed upward through mobile speakers.

The distress call seems to be quite species specific. The call of the starling does not effectively repel common grackles (*Quiscalus quiscula*) or American robins (*Turdus migratorius*). Furthermore, starlings which have been in captivity for some time usually do not emit the call, or emit a variant which sounds like the cawing of a crow and is relatively ineffective against roosting birds.

Trees from which starlings have been frightened are

[1] Authorized for publication as Paper No. 1839 in the Journal Series of The Pennsylvania Agricultural Experiment Station. This work was financed in part by the U.S. Air Force Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, under Contract No. AF-33(038)-786. Grateful acknowledgment is hereby expressed to those persons who lent us equipment or aided in the tests.

avoided even by birds driven from other places. These birds fly toward the trees as if to settle, but veer off before alighting, as though there were some warning odor on the trees. This may seem strange in view of the prevalent opinion that birds lack olfactory sensitivity, but this opinion may not be correct (*2, 3*).

The use of a distress call or alarm call as a repellent may not be entirely new, but the method of application seems to be. Shooting at starlings drives them away if consistently continued (*1*), but this is expensive, dangerous, and harmful to protected species. It is certainly the sound that repels the birds, and recording with subsequent rebroadcast would obviate these difficulties.

If the general principle proves valid, it may be possible to repel other birds from objectionable roosts or from molested crops by using their distress calls. It might also be possible to use similar means to repel rodents or other mammals, or even insects such as moths (*4*), if ultrasonic frequencies are recorded and broadcast.

As far as starlings are concerned, this report must be considered as preliminary. Tests must be made in large cities, and the best times and methods of application must be determined. These studies indicate a lasting effect following the treatments, but only time will tell how lasting. Finally, much further work is needed on the habits of starlings and other pests, for this knowledge is the key to ultimate success in controlling them.

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Current Volcanic Activity in Katmai National Monument

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U. S. Geological Survey, in cooperation with the Katmai Project, National Park Service, Washington, D. C.

The combination of geological and meteorological circumstances which on July 9, 1953, caused a ¼-in. layer of volcanic ash to be deposited on the city of Anchorage (*1, 2*) focused popular attention on volcanic activity at the northern end of the Aleutian Range. The daily routine of a city of 50,000 population was unbalanced, the power and water supplies were partly disrupted, and air traffic was temporarily halted at three of the nation's busiest fields by a single, relatively minor volcanic eruption. This incident served to point up the timeliness of the National Park Service's emphasis on volcanology in investigations in Katmai National Monument during the summer of 1953 and the pertinence of the extended studies in the Aleutian Range by the Geological Survey's Volcano Investigations Unit (*3*).

Within the limits of the Monument are 15 recently active volcanoes. The spectacular activity in February of one of these, Mount Trident, has subsided to slow extrusion of very viscous blocky lava, accompanied by steady vigorous steaming. Six other volcanoes, Martin, Mageik, Novarupta, Knife Peak, Kukak, and Douglas, steamed with varying degrees of intensity during the summer of 1953.

Air photographs taken in July, 1951, showed Mount Trident, an eroded volcano without historical record of previous eruption (*4*), to be steaming from a vent at an altitude of approximately 3600 ft, southwest of its middle peak. On February 15, 1953, activity of this vent entered a violent phase that continued for several days with a series of explosive eruptions sending clouds of steam and ash to altitudes of 30,000 to 35,000 ft. Although the volcanic clouds were not visible from Kodiak, they were clearly seen and photographed from King Salmon, 70 mi to the west-northwest. On February 18 aerial observers noted a flow of viscous lava being extruded from the vent. During subsequent months the plume of steam and ash was frequently seen, rising a mile or two above the cone.

On June 19 a base camp was established on Knife Creek near the foot of Trident Volcano. From this point short trips were made throughout the Monument, and all the major peaks were visited.

From June to September Trident's activity was marked by quiet extrusion of lava accompanied by steady, moderately vigorous steaming. The flow is dark brown and blocky on the surface, but it continues to steam from hot viscous lava beneath. The flow continued to spread on the west margin, greatly increasing in volume without any evidence of abatement toward the end of the summer. Quiet steaming continues both from the new fumarolic area at an elevation of 4200 ft southeast of the middle peak (*5*) and from a large fumarole several hundred feet downslope (*6*). There is no sign of lava extrusion at either fumarole, but marked incrustation of yellow sublimates has occurred at the upper one.

During June Trident's plume of steam was visible on clear days from the shore of Bristol Bay, 80 mi to the west. Several times, with suitable winds, it spread far enough west to restrict visibility at King Salmon, and in early June traces of ash were reported on the vegetation 90 mi west-southwest at Egegik. On July 12 streamers of pyroclastic material were reported falling from the plume near the cone. In general, however, the cloud consists principally of steam with occasional small amounts of ash. Within a radius of about 10 mi of the cone, an inch or more of ash from the February eruptions mantles late-lasting snowdrifts, retarding their melting to about one-fifth of the normal rate.

In recent years Mount Martin, a 6050-ft peak 11 mi southwest of Mount Trident, has been one of the steadiest performers in this part of the Aleutian

[1] Deceased.

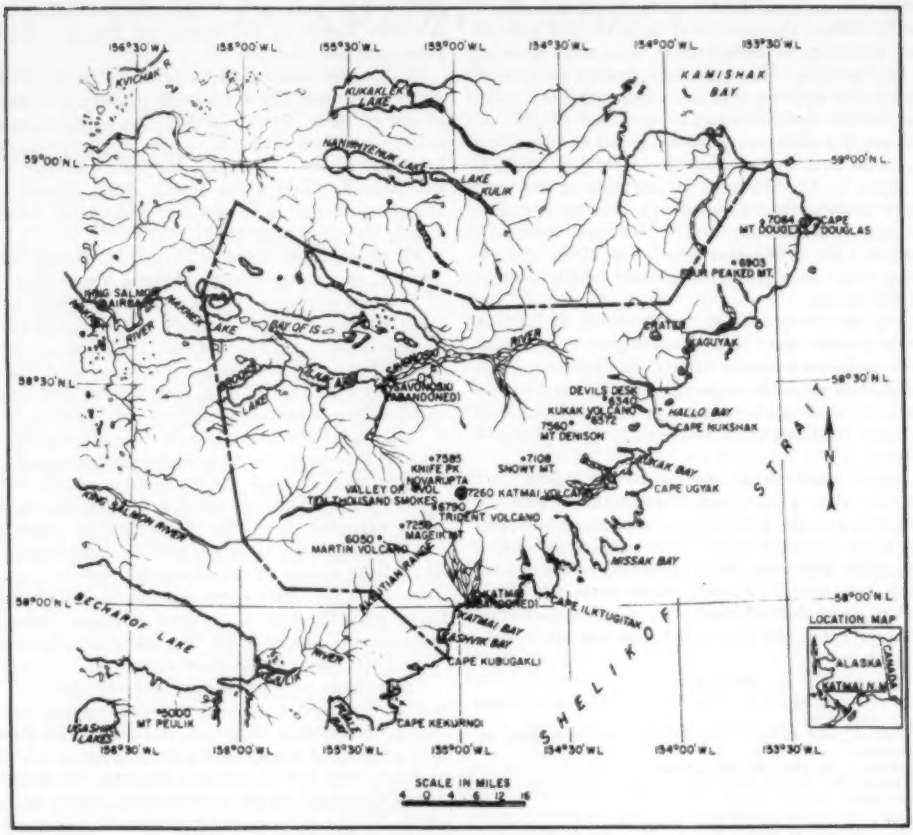

FIG. 1. Katmai National Monument showing location of active volcanoes.

Range. Because of Mount Martin's location, some of its activity has been incorrectly attributed to its larger neighbor to the northeast, Mount Mageik. Probably both the ashfall at Kukak Bay on July 22, 1951, and the eruptions reported as occurring simultaneously with Mount Trident's activity in February, 1953, came from Mount Martin. During the second week of July, Mount Martin was observed to be steaming steadily and with moderate vigor, although its plume was less conspicuous than that of Trident. During this interval, only quiet steaming occurred at the crater near the crest of Mount Mageik.

During July mild fumarolic activity was reported near the crest of Knife Peak by James Mulkern, a pilot with a topographic survey unit of the Army Corps of Engineers. This peak has no history of more vigorous activity.

Kukak Volcano, which had been steaming steadily, emitted a single large puff of steam on July 22 according to the captain of the Fish and Wildlife Service's ship, *Dennis Wynn*. At the end of July considerable steam was escaping from large caverns in Hook Glacier on the flank of Kukak Volcano, possibly indicating the position of newly activated vents.

Activity at the northeast end of the Alaska Peninsula is limited to quiet steaming from several small vents near a crater lake at the summit of Mount Douglas.

Although Mount Katmai is at present apparently inactive, it retains considerable latent heat, for the crater lake is reported to remain unfrozen even in midwinter. Novarupta, a dome of viscous lava 5 mi southwest of Katmai Crater, continues to steam very mildly, but there is no evidence of the more violent activity suggested in early reports of the February eruption of Mount Trident. A system of fissures in arcuate arrangement around Novarupta from west to northeast is marked by many small fumarolic vents. Activity in the Valley of Ten Thousand Smokes has lapsed except for a few remaining fumaroles.

Popular accounts have tended to sensationalize recent eruptions in the northern part of the Aleutian Range. Increased air traffic and gradual settlement of adjacent areas make it less probable that an eruption

would escape detection today than a few decades ago. No activity during the course of this season or recent seasons has been of the order of magnitude of the explosive eruption of Mount Katmai in June, 1912. That eruption partly destroyed one of the highest peaks in this portion of the range, created a crater 1½ mi in maximum dimension, and ejected 25 to 50 times the volume of material involved in Trident's February eruption (7). The greater frequency of mention of volcanism in this area during recent months probably reflects a more general awareness of the activity but not necessarily greater frequency or intensity of eruptions.

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Manuscript received December 22, 1953.

Filtration of Embryo Extract for Tissue Cultures[1]

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The discipline commonly called "tissue culture" has long suffered from the apparent complexities of its procedures. Bryant, Earle, and Peppers have recently published on "The effect of ultracentrifugation and hyaluronidase on the filtrability of chick-embryo extract for tissue cultures" [*J. Natl. Cancer Inst.* 14, 177 (1953)], which we wish to commend as a contribution to mass technics. We should like to note, however, that many of the complicated procedures and the correspondingly expensive equipment described may be omitted.

We have been using hyaluronidase-treated chick-embryo extract in the maintenance of Earle's "strain L" cells for about 8 mo.[3] Our cultures show a uniform cellular increase of sufficient rapidity to require subculturing (dividing into 3–10 aliquots, usually 6) at about 10-day intervals. This is not the maximum proliferation rate, which is not required for maintaining stock cultures.

Our procedure is as follows: We open a dozen "fertile" eggs, incubated 10 days. These will usually provide 8–10 embryos which are collected in a small Petri dish. They are then dropped into the barrel of a 20-ml Luer syringe. We do not use a screen insert. The plunger is inserted and the tissue pulp forced into 15-ml conical Pyrex centrifuge tubes, allowing about 5 ml of pulp per tube. No complex grinders are needed. We then add an equal quantity of Earle's balanced salt-dextrose solution, stir thoroughly with a spatula or glass rod, and place in the refrigerator at +5° C overnight. No freezing with CO_2 is required. The following day the extract is separated by centrifuging for 10 min at about 3000 rpm. No ultracentrifugation is needed. The clear supernatant is decanted, and can either be used immediately in the preparation of nutrient (which is our usual practice), or can be stored in the freezing part of the refrigerator at −15° C.

The complete nutrient comprises 1 volume of extract, 2 volumes of horse serum, and 7 volumes of balanced salt solution. About 10 mg of hyaluronidase are added to each 100 ml of nutrient, and the whole is filtered through a Selas candle of No. 03 porosity. We do not use a pressure filter. A water pump or mechanical vacuum pump is satisfactory, but the vacuum should be kept below 250 mm of mercury by use of a bleeder valve. One hundred and fifty milliliters of nutrient will filter without clogging a 2-in. filter and with almost 100 percent yield in about 10 min. The clear sterile filtrate is drawn off into tubes and either used immediately or stored at +5° C. A dozen eggs will usually provide about 15 ml of embryo extract (1:1) or 150 ml of complete nutrient. The solution has a final composition of 10 percent embryo extract, 20 percent horse serum, and 70 percent balanced salt solution. This is only half as concentrated for both embryo material and serum as recommended by Bryant *et al.*, yet we find it entirely satisfactory for routine maintenance of "strain L" cells in 3.5-cm Carrel flasks without substratum (cells growing directly on glass, no cellophane or clot). It is also to be noted that we do not "gas" the nutrient or the flasks with a special gas mixture. Air is quite satisfactory.

In this procedure we have utilized three of the steps recommended by the above authors: a Luer syringe as a grinder, hyaluronidase as a depolymerizer, and filtration through the No. 03 Selas candle. We have eliminated the use of a wire screen in the syringe, preliminary freezing with CO_2 ice, grinding in a Potter-Elvehjem grinder, ultracentrifugation, use of a pressure filter, and gassing of the culture flasks. The equipment needed is to be found in most laboratories. The procedures can be carried out by a student after a little instruction. We believe that the results are not inferior to those obtained by more complex methods.

It is our belief that many of the difficulties encountered by Bryant *et al.* have arisen from the series of procedures used. If one presses tissue through a 24-mesh wire screen, then freezes in CO_2 ice, and grinds in a Potter grinder, one obtains a suspension containing much fine particulate matter which clogs the filter. It is doubtful if this excessive trituration provides any

[1] Work supported by a grant from the American Cancer Society, made upon recommendation of the Committee on Growth of the National Research Council.

[2] A.C.S.-B.E.C.C. Fellow 1952–53 from the Chester Beatty Research Institute, London, England.

[3] We are indebted to Dr. Earle for communicating to us information on the use of hyaluronidase for this purpose prior to publication.

greater final yield of water-soluble extract than does centrifuging at low speed a coarser suspension after standing overnight. By filtering after completion of the nutrient we are filtering a 1:20 instead of a 1:1 dilution of the substances extracted from the embryo tissue. This filtration can be carried out without hyaluronidase, but addition of the latter speeds up the process enough to justify its use.

Bryant *et al.* have made a notable contribution in elucidating many details of embryo-extract behavior. The simpler methods we have described produce a medium perfectly adequate for the maintenance of stock cultures of the cells of "strain L."

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Hiptagenic Acid, a Toxic Component of *Indigofera endecaphylla*

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Various species of *Indigofera* have been used for many years in the Orient as forage and cover crops. One species, *Indigofera endecaphylla*, Jacq. (trailing indigo or creeping indigo) showed great promise when established in Hawaii and Latin America. In Puerto Rico a pasture cafeteria experiment using cattle as test animals, showed *I. endecaphylla* to be outstanding on the basis of yield, palatability, protein content, and recovery after heavy grazing (*1*).

Several years after *Indigofera endecaphylla* was introduced into Hawaii, it was observed that this legume produced severe toxic symptoms in herds of dairy cattle (*2*). These symptoms included loss of appetite, dizziness, abortion, and even death, if the cattle were not removed from the trailing indigo pasture. Extended feeding tests with guinea pigs were then carried out in Puerto Rico (*3*). These tests showed that guinea pigs were able to survive indefinitely (2 yr) on a diet in which *I. endecaphylla* constituted the only green forage. The test animals maintained normal weight and appeared normal in every way except for the fact that the pregnant females invariably aborted during early or middle pregnancy. Feeding tests with chicks showed that the lethal dose for a 1-wk-old chick was about 5 g of dry plant material.

In view of the outstanding agronomic characteristics of trailing indigo, a breeding program aimed at producing a nontoxic variety of trailing indigo has been initiated. If such a variety can be developed, it will constitute an important contribution to tropical agriculture.

The breeding program for trailing indigo required a method of analysis that would use no more than a single plant for each assay. Because individual plants may yield as little as 1 g of dry plant material, the possibility of using animal feeding tests as a method of assay was eliminated. In seeking a satisfactory chemical method of assay an investigation of the chemical nature of the toxic principle was made.

Extraction tests with various solvents showed that no toxic material could be extracted with nonpolar solvents such as chloroform, benzene, carbon tetrachloride, and ether. It was found that a substance which was highly toxic to chicks was readily extracted with hot water. Further, it was found that this toxic material could then be extracted from the aqueous solution by repeated extractions with ether. The toxic mixture obtained after the evaporation of the ether crystallized when taken up in hot benzene and cooled. The crude crystalline material melted at 63°–65°. A highly purified sample obtained from a silicic acid column melted at 67.5°–68°. Qualitative tests showed the presence of carbon, hydrogen, and nitrogen. Quantitative analysis for carbon, hydrogen, and nitrogen indicated an empirical formula of $C_3H_5NO_4$. Aqueous solutions were strongly acidic; and points of inflection on the titrametric curve indicated equivalent weights of 59 and 118. Molecular weight determinations in benzene gave figures of 235 to 245, thus indicating dimerization in nonpolar solvents. As the acid was dibasic, it seemed probable that the 4 oxygen atoms in the molecule could be accounted for by 2 carboxyl groups. The fact that this compound smoothly evolved carbon dioxide when heated to 130°–140° added weight to this idea. However, qualitative tests showed that the nitrogen atom was in an oxidized state, and therefore the toxic compound could not be a dicarboxylic acid.

A literature search based on the above information showed that this toxic, dibasic acid was identical with hiptagenic acid, the aglycone of hiptagin, a toxic glucoside first isolated by Gorter (*4*) from *Hiptage benghalensis* (metablota) a plant native to India. This conclusion was not obvious from a comparison of the available physical and chemical properties of the two substances. Fortunately however, 3 plants of *Hiptage benghalensis* had been introduced from the Orient by the Bureau of Plant Industry in 1939, and were being maintained here at this station (P. I. 116513). This permitted a direct comparison of the two compounds. Both gave the same crystalline forms, melted at 67.5°–68°, and had the same composition and identical titrametric curves. The mixed-melting-point was 67°–68°; the ultraviolet absorption curves were identical and showed a maximum at 276 mμ.

The unusual and often complex chemical reactions of hiptagenic acid have made the elucidation of its molecular structure difficult. Several different formulae were proposed before Carter (*5*) presented what appears to be conclusive proof that hiptagenic acid is identical with β-nitropropionic acid. Another group of investigators (*6*) has reported that β-nitropropionic acid is a metabolic product of *Aspergillus flavus*. If hiptagenic acid and β-nitropropionic acid are identical, then this compound is the first and only aliphatic nitro compound ever isolated from natural sources. This simple, three carbon, nitrogen-containing acid has now been isolated from several different spe-

[1] Administered by the Office of Experiment Stations, Agricultural Research Service, USDA.

cies of plants; and the possibility exists that it may play an important role in nitrogen metabolism.

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The Determination of Chloride by Use of the Silver-Silver Chloride Electrode[1]

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Accepted methods for the determination of chloride may be grouped mainly under four headings: (a) gravimetric; (b) titrimetric, with color indicators; (c) potentiometric, with titration; and (d) optical. Attempts have been made to adapt these methods so that they may be used in dilute solutions and with biological materials, but such adaptions are usually time consuming and not too accurate. This paper describes an improved potentiometric method for chloride ion determination. The time required for a complete determination should be no more than one minute.

A consideration of the Nernst equation shows that, with the proper electrode pair, it should be possible to set up a concentration cell for the determination of almost any ion. The voltage will not be affected by the presence of biological material, and there should be minimal interference from other ions. Tremblay (*1*), Neuhausen and Marshall (*2*), Duxbury (*3*), and Katsu (*4*) decided that the method has only very limited application. One of the greatest difficulties has been drifting. Drifts have been eliminated in the present investigation by making all dilutions with a buffer solution of pH 7. These drifts are due to the changing pH, which is caused by the absorption of atmospheric CO_2.

There is a daily change in the voltage developed by known chloride concentrations, so it has not been possible to compute values from theoretical considerations (*1, 2*). It is necessary to plot a reference curve each time the electrodes are used, but because the voltage is a logarithmic function of concentration, only two points are needed. These are plotted on semi-log paper, and the straight line that connects them is the desired curve. Dilutions should be made so that the final unknown chloride concentration is in the range of 0.1 to 1.0 milliequivalents per liter. Also, the concentrations of at least two different dilutions of the same unknown should be determined. There should be insignificant variation when the original concentration is computed.

[1] Supported by a grant from the National Tuberculosis Association and the California Tuberculosis Association.

[2] The author acknowledges the consultative assistance of Wendell H. Griffith, Chairman of the Department of Physiological Chemistry at the University of California Medical School at Los Angeles.

Table 1. Millivolt readings for various concentrations of chloride with the silver-silver chloride electrode.

Concentration (Milliequivalents per 1000 ml)	Reading (mv)
2.0	245
1.5	239
1.0	230
0.9	227
0.8	225
0.7	222
0.6	219
0.5	215
0.4	209
0.3	203
0.2	194
0.1	178

The electrodes used in the present investigation are a mercury-mercurous sulfate reference electrode (which has provision for a saturated potassium sulfate bridge built into it),[3] and a silver-silver chloride electrode.[4] The latter electrode is a rod of solid silver, and is shipped with a silver chloride coating already on it. This coating must be renewed completely before it can be used, as unexplained drifts occur with an insufficiently pure silver chloride coating.

The following method for renewing the silver chloride has worked best. Scour the silver electrode with cleansing powder until no purple brown color can be seen. Rinse with distilled water and then connect to the negative pole of a 1½-v dry battery. Connect a platinum electrode to the positive pole, immerse the electrodes in dilute ammonium hydroxide, and allow current to flow for about 1 min. Remove the electrode, wipe off any discolored material, and rinse with distilled water.

Coating with silver chloride is now effected by electrolyzing in a saturated solution of reagent-grade potassium chloride. Connect the clean silver electrode to the positive pole of a 1½-v dry battery, a platinum electrode to the negative pole, and allow current to flow for 20 sec. Without rinsing, place the freshly prepared silver-silver chloride electrode in distilled

Table 2. Millivolt readings and chloride concentrations for different dilutions of blood serum.

Dilution	Concentration (Milliequivalents per 1000 ml)	Reading (mv)
	1.0	233
	0.1	180
1–100	1.14	236
1–1000	0.114	183

[3] Beckman 1170-9.
[4] Beckman 1264.

water and allow it to stand in contact with the excess chloride ions that have been carried over from the saturated solution, for 30 min. Finally, rinse the electrode with distilled water and place it in distilled water until it is used. The efficiency of the electrode is not impaired if the silver-chloride coating is not uniform. It is important, however, that care be taken to insure that it does not dry out. Electrodes that have been prepared in the above manner have been used for several weeks before they have been recoated.

Voltage measurements can be made, most conveniently, on the millivolt range of a pH meter.[5] However, extreme accuracy requires that a slide wire potentiometer be used. To determine chloride concentration, connect the silver-silver chloride electrode to the positive binding post of the measuring instrument, the reference electrode to the negative binding post, and immerse the two electrodes in the unknown solution. The voltage developed across the electrodes is plotted on the concentration curve, and the unknown concentration is read directly. The electrodes should be rinsed with distilled water and blotted dry with a cleansing tissue between each two determinations. Table 1 shows the voltages developed by pure chloride solutions of various concentrations. Table 2 shows the voltages and the equivalent chloride concentrations for two different dilutions of the same blood serum. Several determinations of chloride in thoracic duct fluid and in buffered extracts of dry muscle tissue have been made. In every case, no drift was observed. The chloride concentration in thoracic duct fluid is identical with that of the corresponding blood serum, and the chloride of the muscle checks with values that have been found in the literature. Urine chloride has also been determined.

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[5] The Beckman Model G was used.

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A Simple Method for the Calculation of Electrode Potentials in Polarography[1]

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In polarographic work it is frequently necessary to convert applied voltage to electrode potential. This is accomplished by subtracting the product of current i, and total circuit resistance, R, from the applied voltage. This product is referred to as the iR factor. Its evaluation is a cumbersome operation and involves the separate experimental determinations of the current

[1] Carried out on a contract between the Office of Naval Research (N6 ONR 25137) and Stanford University.

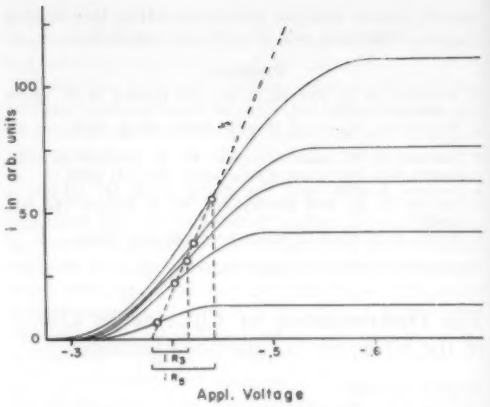

Fig. 1. Five concentrations of $Pb(NO_3)_2$ buffered to pH 6.8.

and of the resistance. The proposed method is simpler, because the iR factor can be obtained directly from a polarogram employing the low-voltage range customary in polarography;[2] thus the iR factor can be evaluated without the separate determination of either i or R.

The electrode potential corresponding to a given ratio of oxidant to reductant is a characteristic constant of a given substance and is independent of the concentration. An easily measured potential of this kind is the half-wave potential, where the ratio of oxidant to reductant is unity for all substances that are reducible or oxidizable at the electrode. If, however, current-voltage curves of the same substance are

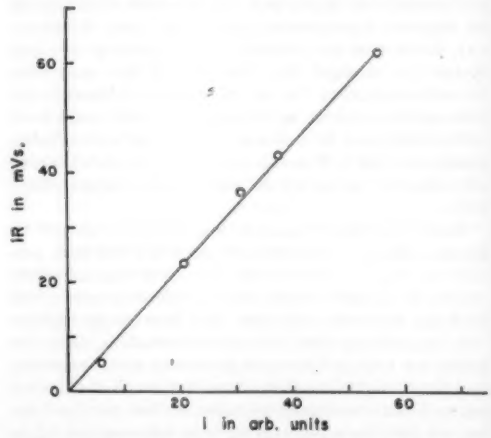

Fig. 2. Calibration curve constructed on the basis of Fig. 1.

[2] Müller's determination of the iR factor involves the application of higher voltages. O. H. Müller, *The Polarographic Method of Analysis*, p. 97. Easton, Pa.: Chemical Education Pub., 1951.

recorded at different concentrations, a gradual shift of the half-wave potential is observed with increasing concentration. This shift is entirely due to the increase of the iR factor, and for constant resistance the shift is a linear function of the current i. If the current values corresponding to the "half-wave voltages" are connected by a straight line, the intercept of this line with the voltage axis will be the true half-wave potential of the substance (Fig. 1); since at this point i is zero, iR must also be zero. The difference between the half-wave voltage and the thus determined half-wave potential for any particular curve will be the iR correction corresponding to the current value in question. It can readily be seen that if the resistance is kept constant, iR will depend solely on i.

Although the half-wave potential represents a convenient reference value to be used in constructing such a plot, it is emphasized that the same slope will be obtained if any other set of homologous points, that is, current values corresponding to some constant ratio of oxidant to reductant, are connected. The intercept with the voltage axis in such a case will be the electrode potential for that particular ratio. It follows, therefore, that *any* measured i value is displaced along the voltage axis by an amount iR, which is determined entirely by i.

If the iR factors thus determined are plotted against i (Fig. 2), the voltage correction can be read from the graph for any i value. Since only voltage differences are calculated in the evaluation of iR, the factors determined by this method are independent of the nature of the substance employed for the determination of the half-wave shifts; and as long as the resistance and the galvanometer sensitivity are constant, the factors are applicable to all current values. If the current is expressed in amperes, the slope of the iR/i plot will give the resistance of the circuit in ohms.

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Communications

Rare-Earth Mineral Deposits of the Mountain Pass District, San Bernardino County, California

BASTNAESITE, a rare-earth fluocarbonate, was found in the Mountain Pass district in April, 1949. Subsequent geologic mapping has shown that rare-earth mineral deposits occur in a belt about 6 mi long and 1½ mi wide. One of the deposits, the Sulphide Queen carbonate body, is the greatest concentration of rare-earth minerals now known in the world.

The Mountain Pass district is in a block of pre-Cambrian metamorphic rocks, bounded on the east and south by the alluvium of Ivanpah Valley, and separated on the west from sedimentary and volcanic rocks of Paleozoic and Mesozoic age by the Clark Mountain normal fault; the northern boundary of the district is a conspicuous transverse fault. The pre-Cambrian metamorphic complex comprises a great variety of lithologic types.

The rare-earth-bearing carbonate rocks are spatially and genetically related to potash-rich igneous rocks of probable pre-Cambrian age that cut the metamorphic complex. The larger potash-rich intrusive masses, 300 ft or more wide, comprise one granite, two syenite, and four composite shonkinite-syenite bodies. One of the shonkinite-syenite stocks is 6300 ft long. Several hundred relatively thin dikes of these potash-rich rocks range in composition from biotite shonkinite through syenite to granite. Although a few thin fine-grained shonkinite dikes cut the granite, the mafic intrusive bodies generally are the oldest and granitic rocks the youngest. The potash-rich rocks are intruded by east-trending andesitic dikes and are displaced by faults.

Veins of carbonate rock are most abundant in and near the southwest side of the largest shonkinite-syenite body. Most veins are less than 6 ft thick. One mass of carbonate rock near the Sulphide Queen mine is 700 ft in maximum width and 2400 ft long. About 200 veins have been mapped in the district; their aggregate surface area is probably less than one-tenth that of the large carbonate mass.

The carbonate minerals, which make up about 60 percent of the veins and the large carbonate body, are chiefly calcite, dolomite, ankerite, and siderite. Other constituents are barite, bastnaesite, parisite, quartz, and small quantities of crocidolite, biotite, phlogopite, chlorite, muscovite, apatite, hematite, goethite, fluorite, monazite, galena, allanite, cerite, sphene, pyrite, chalcopyrite, tetrahedrite, malachite, azurite, strontianite, cerussite, wulfenite, aragonite, and thorite. The rare-earth oxide content of much of the carbonate rock is 5 to 15 percent; in some local concentrations of bastnaesite the rare-earth oxide content is as high as 40 percent.

The foliation and inclusions in the Sulphide Queen carbonate body, and the discordant contacts between this body and the gneissic wall rocks, show that the carbonate rock was intruded as a mass into its present position. Radioactive determinations on monazite from the Sulphide Queen carbonate body indicate a tentative age of 770 million to 1100 million years (pre-Cambrian), and the potash-rich rocks are at least as old, and thus are of pre-Cambrian age.

Because of structural reasons, as well as the pre-Cambrian age of the monazite, the rare-earth-bearing carbonate rock could not have originated as sedimentary limestone or dolomite of Paleozoic age or through assimilation of sedimentary rocks of Paleozoic age by the parent magma of the potash-rich rocks. It might have had a sedimentary origin in the pre-Cambrian gneissic complex as limestone or evaporite, subse-

quently modified and squeezed into discordance with the foliation of the metamorphic rocks. A magmatic origin of the rare-earth-bearing carbonate rock by differentiation of an alkalic magma from shonkinite to syenite to granite, with a carbonate-rich end product containing the rare elements, is in harmony with the field relations. This late differentiate might have been introduced either as a relatively concentrated magmatic fluid, highly charged with volatile constituents such as carbon dioxide, sulfur, and fluorine, or as a dilute hydrothermal fluid.

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Navajoite, a New Vanadium Oxide from Arizona

Navajoite, hydrated vanadium pentoxide, is a new mineral found in the Monument No. 2 mine, on the Navajo Indian Reservation, Apache County, Arizona, and named in honor of the Navajo Indians. The mine is in a vanadium-uranium deposit just north of Comb Ridge in Monument Valley. The ore occurs in a channel that is filled with Shinarump conglomerate (Triassic) and that extends down through the Moenkopi formation (Triassic) into the DeChelly sandstone member of the Cutler formation (Permian).

The mineral, navajoite, occurs in highly oxidized ore in one part of the Monument No. 2 mine. It impregnates conglomeratic sandstone and silty sandstone, forms seams in the sandstone and crescent-shaped coatings above and below pebbles, and fills small fractures in clay lenses. The associated minerals include only one with V^{+4} and V^{+5}, corvusite; the rest are fully oxidized: tyuyamunite, rauvite, hewettite, steigerite, and limonite.

Navajoite is dark brown, soft, and fibrous, with a silky luster and brown streak. The specific gravity measured on the Berman balance is 2.56. The mineral is optically biaxial, probably negative, has parallel extinction and α is 1.905 ± 0.003, β about 2.02, and γ slightly above 2.02, with pleochroism X yellowish brown, Y yellowish brown, and Z dark brown and parallel to the fiber length. The chemical analysis, by A. M. Sherwood, shows 71.68 percent V_2O_5, 3.08 percent V_2O_4, 3.58 percent Fe_2O_3, 20.30 percent H_2O, 1.20 percent SiO_2, 0.22 percent CaO, and a total of 100.06 percent, and it indicates the formula $V_2O_5 \cdot 3H_2O$. Navajoite is readily distinguished by x-ray powder pattern from hewettite and corvusite, which it may resemble in physical appearance. Although the silky fibers of navajoite are too small for single crystal x-ray study, a rotation photograph of a small bundle of fibers indicated that the unit cell length along the fiber is about 3.65 A (H. T. Evans, personal communication, 1953). A large-scale photograph of the zero layer, obtained by placing a fiber bundle in a powder camera and using chromium radiation, shows many lines. Study of the photograph indicates that the two axes other than the fiber length are not at right angles and that navajoite is probably monoclinic, with the fiber length parallel to the *b*-axis. The best graphical solution of lattice constants found by plotting the reciprocal lattice spacings of the *h*0*l* lines suggests that $a_o = 17.43 \pm 0.1$ A, $b_o = 3.65 \pm 0.05$, $c_o = 12.25 \pm 0.1$, and $\beta = 97° \pm 30'$. This unit cell would hold approximately 6 formula weights of $V_2O_5 \cdot 3H_2O$.

Navajoite would be an excellent vanadium ore mineral because of its high vanadium content, but unfortunately the mineral is probably not abundant in the ores of the Colorado Plateaus. This is because V^{+5} readily combines with other elements such as Ca, K, Na, Mg, Fe, Al, and U that are commonly present in the ore and because the hydrated vanadium pentoxide may form only under unusually acid conditions.

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Studies of River Morphology

A number of generalizations concerning the behavior and natural characteristics of river channels have been developed by the U.S. Geological Survey in several recently completed studies of river morphology. Measurements of parameters such as the discharge, suspended load, bed material, velocity of flow, channel slope, and channel shape indicate that many river channels are characterized by an orderly, progressive change of these variables from their headwaters to their mouths. The interaction of the variables and the establishment of a stable channel suggest that the morphology of the stream is controlled by a kind of equilibrium.

This concept of the interaction of a number of variables constituting a kind of equilibrium is the basis of present studies of the origin and operation of meanders, braids, and straight channels. These studies are in four principal parts:

(1) From field measurements of the aforementioned parameters, an effort is made to separate (isolate) the distinguishing physical features of each pattern. For example, in addition to their characteristic islands, braided streams frequently have steeper slopes, wider and shallower channels, and coarser bed material. On the other hand, detailed studies reveal marked similarities in the profiles and patterns of flow in meanders and straight channels.

(2) To understand the mechanics controlling the meander pattern, measurements are being made of the distribution of velocity and discharge in successive cross sections in the direction of the flows.

(3) Where possible, model studies supplement the

field observations. The models are designed to simulate the characteristics observed in the prototypes.

(4) An attempt is being made to express the results of these studies in terms of rational laws. It is hoped that ultimately these rational laws can be arrived at independently and tested with the empirical data.

These studies are important for the control and regulation of rivers. Also, because rivers play an important part in the sculpture of the landscape, the studies of river morphology fit into the broader geological programs of the Geological Survey which are concerned with geological processes and their part in historical geology.

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Geologic Map of Wyoming

A NEW full-color geologic map of Wyoming, which has been in preparation since 1946 by the U.S. Geological Survey, is now rapidly approaching completion. It will be an almost complete revision of the original state geologic map published in 1925, and a refined and slightly revised version of a black and white map of Wyoming published in a preliminary edition in 1952.

The new colored map shows the distribution, comparative thickness, and structural trend of various geologic units. Most of the major mountain ranges in the state are distinguished by a core of pre-Cambrian rocks surrounded by concentric outcrop bands of Mesozoic and Cenozoic rocks. Cenozoic rocks also cover a large part of the state outside of mountainous areas. Lava flows and related rocks are most common in the Yellowstone National Park–Absaroka Range area. Large-scale fold systems, delineated by parallelism of certain of the outcrop bands, are particularly noticeable in the west-central part of the state.

Of the 97,000 sq mi in the state of Wyoming, only the geology for 100 sq mi from the 1925 map was reused. Coverage for the remaining 96,900 sq mi was obtained from more than 200 detailed maps from diverse sources, all prepared since 1925. Many of these maps are published, but a large number are unpublished and the information is presented for the first time on the new map. The major sources of material for the new map are publications and files of the U.S. Geological Survey, the Wyoming Geological Survey, faculty and graduate students of the University of Wyoming, and several oil companies. An index map inset shows sources of material used in the compilation.

To emphasize the variation and changes in nomenclature of many of the geologic units in different parts of the state, a separate explanation is given for each of the four quadrants of the state. In many places where the outcrop of a formation is too narrow to be shown as a single unit, it has been included with another unit or a group of units. An outcrop so narrow that it would be less than 1/32 in. on a map could not be shown. Thus in an area where beds are vertical, only units that are thicker than 1300 ft could be shown as independent units.

Maps used in the compilation were mainly within the scale range of 1 : 24,000 to 1 : 63,360. These maps were reduced to the compilation scale of 1 : 400,000 either by photography or by means of a vertical projector. Maps of abnormally large scale were reduced to the compilation scale of 1 : 400,000 in two steps.

The new geologic map, which measures approximately 50 by 72 in. is at a scale of 1 : 500,000 (one in. equals about 8 mi). It is printed on a new base that shows county, state, and federal roads, land grid, settlements, and drainage. The map contains 142 geologic units, each identified by a pattern and by one of 17 different colors, depending upon the system to which it belongs. Seventeen different printing plates and as many press runs will be required to print the geologic map on the prepared base.

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The Molybdenum Blue Reaction and the Determination of Phosphorus in Waters Containing Arsenic, Silicon, and Germanium

PHOSPHATE is an essential nutrient, and from a biological standpoint its determination provides a key to the understanding of one of the important biochemical cycles in the ocean. The accurate determination of phosphate in ocean waters is important to the geochemist because such data are essential to the formulation of possible mechanisms for phosphate rock deposition in marine environments and, similarly, are important to possible interpretations of the association and distribution of the small amounts of other elements usually found in phosphate rock.

Methods for the determination of small amounts of phosphorus are usually based on the formation of phosphomolybdic acid and its subsequent reduction to a blue compound. The molybdenum blue reaction is not specific for phosphorus, as arsenic (V), germanium, and silicon also form heteropoly acids with molybdenum and yield blue compounds on reduction. Although the literature on the molybdenum blue reaction is voluminous, basic data are lacking on all the conditions under which the molybdenum blue reaction for Si, As, P, and Ge can be obtained. One of the aims of the study reported here was to obtain these data, not only to fill some gaps in our knowledge of the chemistry of the heteropoly acids of these elements, but to reveal any differences in behavior that might be of analytical significance. When stannous chloride or 1-amino-2-naphthol-4-sulfonic acid was

used as the reducing agent, no conditions could be found where silicon could be distinguished from germanium and where phosphorus could be distinguished from arsenic (V). Such differentiations probably cannot be made by the selection of some other reducing agent. Under certain acidity conditions, it is possible to minimize the interference of Ge and Si on the phosphorus determination, especially when the organic reductant is used, but such procedures are not recommended.

The recommended procedure for the determination of phosphorus makes provision for the separation of microgram amounts of phosphorus from at least 1 mg each of AS_2O_5, GeO_2 and SiO_2. The phosphate in ocean waters is concentrated by precipitating $Al(OH)_3$, which serves as a carrier for the $AlPO_4$ formed. The small precipitate is treated with a small volume of solution containing HF, HBr, HCl, and H_2SO_4 to volatilize any coprecipitated As, Ge, or Si. The phosphate is then determined by the molybdenum blue reaction according to specific optimum conditions. The total P_2O_5 content of several samples of sea water collected from the Gulf of Mexico ranged from 1.8 to 5.9×10^{-6} percent.

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Received February 5, 1954.

Studies of Evaporation

THE lack of a direct method of measurement of evaporation from large land and water areas constitutes one of the basic gaps in hydrologic inventory. The need for direct measurement of evaporation is particularly keen in the western states where problems of allocation and distribution of available water supplies require accurate accounting.

Ordinarily evaporation (aside from pan estimates) is determined by hydrometric methods, as the difference between measured inflow and outflow. However, the large body of untested theory concerning evaporation processes themselves gives some reason to search for more direct measurements that could be used at the large number of places where hydrometric methods are not applicable or sufficiently precise. Thus it is desired that methods be developed whereby the proposed geophysical principles can be depended upon for primary measurement of evaporation under field operating conditions.

The first step, therefore, was to verify these untested geophysical methods at a lake where it was possible to obtain an accurate determination of evaporation by known and familiar hydrometric methods. Lake Hefner near Oklahoma City, Okla., was chosen for this purpose after an extensive survey of western reservoirs and lakes. Studies were made in 1950 and 1951 in collaboration with the Bureau of Reclamation, the Weather Bureau, and the Department of the Navy. As a result of that investigation it was discovered that good estimates of evaporation can be made by using an empirical equation involving standard meteorological observations together with the surface-water temperature of the lake (embodying some of the principles of the mass-transfer theory), or by using the energy-budget method for periods of 7 days or longer. The Cummings Radiation Integrator was found to be a satisfactory instrument for use with the energy-budget method. Coefficients for evaporation pans were found to have a pronounced seasonal variation so that they are considered useful only for determining annual evaporation.

The results of the Lake Hefner investigation were sufficiently conclusive to permit the determination of evaporation from Lake Mead, the original incentive for the Lake Hefner experiment. These studies, however, led to investigation of new problems, one of which is determining evaporation from reservoirs in advance of construction. Model studies, involving a model of Lake Hefner in the wind tunnel at Fort Collins, Colo., are being made to see if such an approach will solve the problem. Also, a pilot study is being made to see if heat-budget and mass-transfer methods can be used to determine water losses from land areas, including transpiration as well as evaporation. Other studies on various phases of evaporation are planned, but field work has not yet begun.

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Received February 10, 1954.

Developed and Potential Water Power of the United States and Other Countries of the World

THE development of water power in the United States as well as in the entire world has shown a phenomenal increase since 1920. At that time data on the installed capacity of water-power plants, with estimates of the potential water power available, were first compiled by the Geological Survey and published by the Department of the Interior in *World Atlas of Commercial Geology*, Part II: *Water Power of the World*. The average annual rate of increase in installed capacity from 1920 to 1945 was fairly uniform. The rate of increase has been considerably greater since 1945, and scheduled completions for the next few years indicate that it will continue into the future. The installed capacity of water power plants for the United States and the entire world for various years starting with 1920 and percentage comparisons are shown in Table 1.

The development of water power for the world as a whole increased 500 percent from 1920 to 1952, whereas the increase for the United States was slightly over 400 percent. This difference is naturally due to the fact that the United States had made more progress in water-power development than had the other coun-

TABLE 1. Installed capacity of water power plants of the world and of the U.S. compared, 1920–52.

Year* (Dec.)	Total capacity of water-power plants (in thousands of hp)		Comparison with 1920 (%)	
	World	U.S.	World	U.S.
1920	23,000	7,500	100	100
1923	29,000	9,087	126	121
1926	33,000	11,177	143	149
1930	46,000	14,885	200	198
1934	55,000	16,075	239	214
1936	60,000	17,120	261	228
1938	63,900	17,949	278	239
1940	69,400	19,000	302	253
1941	71,600	19,816	311	264
1945	77,800	24,223	338	323
1947	86,900	24,500	378	327
1950	101,000	27,500	439	367
1952	115,600	31,000	502	413

* Years when estimates were made by U.S. Geological Survey.

tries of the world prior to 1920. Development in all countries is continuing at an unprecedented rate.

Water-power developments now in progress will total more than 5,000,000 hp in the next few years in the United States and more than 3,000,000 hp in Canada. The Union of Soviet Socialist Republics reportedly has plants under construction that will total 6,000,000 hp. Developments are in progress in Australia that will total more than 1,000,000 hp. In China consideration is being given to a project on the Yangtze River that would have a capacity of about 15,000,000 hp.

The capacity of water-power plants (1952) and the estimated potential water power for the various continents are listed in Table 2.

Africa is seen to have the largest potential power and the smallest installed capacity of the continents. Actual development of much of this power presents almost insurmountable obstacles owing to inaccessibility and remoteness from possible points of use. Much of Asia's potential power is on large northern rivers, also remote from possible markets.

TABLE 2. Water-power plants and potential water power.

Continent	Capacity of water-power plants, 1952 (in thousands of hp)	Potential water-power based on ordinary minimum flow (in thousands of hp)
Africa	715	250,000
Asia	14,392	156,000
Europe	48,516	64,000
North America	46,430	90,000
Oceania	1,778	23,000
South America	3,962	62,000
World (approx.)	115,793	645,000

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Received February 10, 1954.

Total-Intensity Magnetic Anomalies of Three-Dimensional Distributions by Means of Experimentally Derived Double Layer Model Fields

MODEL experiments have been used for many years in magnetic interpretation because the magnetic fields of geologic bodies can be determined with greater facility experimentally than by calculation. Experiments in the past have usually dealt with the vertical and horizontal components of the magnetic field. We recently completed a series of experiments at the Naval Ordnance Laboratory wherein the total magnetic intensity in the direction of the inducing field was measured for a series of models to devise a rapid method for the interpretation of total-intensity aeromagnetic maps.

Any irregularly shaped magnetic body may be approximated by the proper arrangement of prismatic rectangular slabs of constant thickness and varying horizontal dimensions. The contoured total-intensity magnetic fields of such slabs buried at different depths and subjected to inducing fields of varying inclinations may be determined experimentally. It can be shown that for sufficiently small areas, the direction of the anomalous field may be assumed to be codirectional with the earth's ambient field. Consequently, for an irregular magnetic mass distribution, the field may be obtained by superimposing the appropriate contoured maps and adding numerically the effects at each point.

Experiments were conducted in a building constructed entirely of nonferrous materials. In this building, Helmholtz coils are used to establish a field simulating the earth's magnetic field at the center of the system. With the aid of a potentiometer arrangement, this can be done with accuracy of 10 gammas. Models constructed of a uniform mixture of 1 part powdered magnetite and 2 parts plaster of Paris by volume are placed on a fixed tray in the center of the system. Below the model is a detector, placed on a vertical tower and capable of moving in either a north-south or east-west direction. The detector is a second harmonic flux-gate type magnetometer. The signal is amplified and recorded as a continuous profile as the detector is moved over the model.

The thickness of our models was 0.5 in., and the horizontal dimensions (in inches) were 5×20, 5×30, 5×5, 10×30, 10×10, 20×20, $2\frac{1}{2} \times 20$, 10×20. Fields were mapped with the long axis oriented first parallel to, then normal to magnetic north. Fields were measured in a horizontal plane for model-detector depths at intervals of 0.5 in. between minimum and maximum

depths of 5 and 10 in., respectively. The magnetic dips of the inducing fields were taken to be $I = 0°$, 20°, 30°, 45°, 60°, 75°, 90°.

All the experimentally derived field maps will be made available in a "normalized" form, that is, one that is independent of the susceptibility of the model and the strength of the inducing field, and dependent only on the geometry of the prism. In this manner, complicated bodies may be built up by the proper combination of prismatic blocks, and the total normalized field computed by arithmetically summing up at each point the normalized fields due to each of the prismatic slabs. Multiplication with the susceptibility of the known rock and the inducing field strength will result finally in the desired anomalous magnetic field.

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[1] The authors are indebted to the Electricity and Magnetism Research Division, Physics Research Department, of the Naval Ordnance Laboratory for use of its equipment and for technical and scientific assistance during these experiments.

Received February 10, 1954.

Oligocene Plants and Correlation

A SMALL area of freshwater shale at Florissant, Colorado, has long been noted for its outcrops containing abundant and well-preserved plants and insects and less well known for its scarcer mollusks, fishes, birds, and mammals. The isolation of these fossiliferous strata has caused much speculation about their correct position in the geologic column, but most opinion has fluctuated between Oligocene and Miocene assignments. Within the last 20 yr paleobotanists have reasoned that the flora could not be very much younger, relatively speaking, than that in the middle Eocene Green River formation, because the two have many identical or closely related species in common. A confirmation of this view came with the discovery of an opossum whose affinity was considered to be with Oligocene forms; and more recently, an Oligocene oreodon jaw was taken from beds lying just above the plant-bearing shales. The Oligocene age of the shales, therefore, seems no longer in doubt.

The Florissant flora, according to a restudy by MacGinitie,[1] approximates 150 species, which include pine, spruce, fir, sequoia, white cedar, poplar, willow, hickory, oak, elm, zelkova, Oregon grape, hydrangea, mountain mahogany, hawthorn, rose, redbud, ailanthus, cedrela, smokebush, sumac, maple, dipteronia, koelreuteria, grape, linden, and many others. Can this rich flora now be used for dating other floras in the Rocky Mountain province?

In 1952 my assistant and I spent two days in the hilly area west of the south end of Ruby reservoir, 12 mi south of Alder, in southwestern Montana. From fissile, pinkish shales, somewhat like those at Florissant, we collected many fine leaves, seeds, and insects. The insects include craneflies, bugs, beetles, wasps, ants, mayflies, and grasshoppers, many of which, it appears to me, can be matched in the Florissant fauna. The most startling correspondence, however, is in the floras, although some species present at Alder are absent at Florissant, and vice versa, a circumstance that is not particularly surprising. The species of *Chamaecyparis, Pinus, Picea, Sequoia, Typha, Cercocarpus, Cotinus, Ailanthus, Mahonia,* and *Fagopsis* are, in my judgment, identical in both floras. *Cotinus* and *Fagopsis,* until now, have been unique in the Florissant flora. They have characteristic features that make them readily recognizable. That the Alder locality is in Oligocene deposits is attested by fragmentary mammalian remains from nearby correlative, or slightly higher, whitish strata.

In 1953, together with a U.S. Geological Survey field party, I examined the shales intercalated with ashy and tuffaceous deposits on the west side of the Canyon Ferry reservoir, east of Winston, Montana. These strata had already been dated as Oligocene on the basis of mammalian remains. The shales yielded leaves, seeds, and insects, but these were not as well preserved as those at Alder and Florissant. The plants include species of *Chamaecyparis, Picea, Pinus, Sequoia, Alnus, Betula, Tilia, Zelkova,* and others. Except for the conifers, there is no close tie with the Florissant flora, but most of the dicotyledons are the same as those at Alder. Although these three floras are thus linked together by substantial agreement in composition, they may not have been exactly contemporaneous and the strata containing them may occupy somewhat different positions in the Oligocene series.

ROLAND W. BROWN

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Received February 2, 1954.

[1] MacGinitie, Harry D. Carnegie Inst. Wash. Pub. 599 (1953).

Scribing as a Substitute for Drafting in the Preparation of Maps for Reproduction

A NEW technique of drafting with special tools on coated plastic, known as *scribing,* is rapidly supplanting pen-and-ink drafting in the final stages of map production. An adaptation and refinement of negative engraving used in photolithography, the new method produces a more legible map with neater and sharper line-work in a shorter time and at less cost.

In the older method the printer's copy, the drawings from which printing plates are made, is the product of skilled freehand inking. The map detail is reproduced photographically on metal-mounted paper and traced in ink by the draftsman. A separate drawing is required for each color, the line-weight and registrations must be very precise, and the appearance of the printed map depends largely on the talent and patience of the draftsman. Because of the shortage of competent draftsmen, the operation is frequently a bottleneck in the production line.

With scribing, more dependence is placed on mechanical aids; therefore the result is more uniform. A

clear plastic base sheet to which the map copy is photographically transferred is first coated with an opaque material, usually yellow paint. Using a metal stylus ground to the width of line desired, the draftsman traces the copy, cutting out the opaque coating along the lines that are to be printed. The product is a line negative that the photoengraver can use directly to make the printing plate.

The principal advantage of scribing is that the width of a line is determined entirely by the scribing tool used, in contrast to pen-and-ink drafting where line-weight depends on the size of the pen point, the fluid qualities of the ink, the surface paper, and on the pressure on the pen. The map scriber has few critical factors to control, and he can devote his full attention to productive work. The training period for new employees is relatively short, and their output is superior, both in quantity and quality, to pen-and-ink drafting.

For the "gadgeteer," scribing has opened up a new field of activity—the design of special tools for the various symbols and types of lines on topographic maps. The usual tool is made from a phonograph needle ground to a chisel-shaped point and held in an ordinary pen-holder, but many others have been developed for particular purposes. A swivel-head scriber cuts two parallel lines at the same time to trace double-line roads; a special templet is used to cut rectangular building symbols; and there is even a motor-driven scriber to produce small circles representing oil or water tanks. There is still an unfilled need for a device to scribe dotted lines conveniently and accurately.

The most critical problems in the introduction of scribing techniques concern the materials—the base sheets and the opaque coatings. The base sheet must be transparent, dimensionally stable, and have a smooth surface hard enough to prevent scratching by the scribing tool. Glass is the ideal material so far as these qualities are concerned, but it is fragile and heavy, and the problems of transportation and storage are formidable. After considerable experimenting, a type of vinyl plastic sheeting was selected as the most satisfactory, although there is still room for improvement.

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Book Reviews

Geology of India. Rev. ed. D. N. Wadia. London: Macmillan; New York: St Martin's Press, 1953. 552 pp. Illus. + plates. $10.00.

This reviewer, quite lacking in knowledge of India, found the revised edition of *Geology of India* by Wadia, both pleasant to read and instructive. Persons acquainted with Indian geology perhaps could find gaps in the descriptions and might disagree with some of the interpretations offered or with the emphasis given certain topics. After all, India is nearly half the size of the United States and it would be next to impossible to obtain agreement about the items that should be emphasized in 550 pages describing the geology of half this country.

The first 57 pages describe the physical features, including the physical geography of the three great physiographic divisions of India, the drainage system, lakes, glaciers, coasts, true volcanoes, mud-volcanoes, earthquakes, tilt records, isostasy, climatic conditions, soils, erosion, and résumé of the history of major drainage changes.

The main part of the book (354 pp.) is devoted to a description of the formations, geological history they record, and some of their unsolved problems. This description is apportioned as follows: General introduction to the stratigraphy, 17 pages; pre-Cambrian formations, 62 pages; Paleozoic formations, 95 pages; Mesozoic formations, 58 pages; Deccan trap, 13 pages; and Cenozoic formations, 109 pages.

Following the stratigraphic descriptions and history is a 26-page chapter on physiography. The last chapter (76 pp.) describes the mineral resources and soil.

Accompanying the book is a 1 : 6,000,000 geologic map of India in colors. It would have been helpful to have had additional larger scale maps showing the locations of the many places referred to by name in the text. Too, this reviewer would not share Wadia's pessimistic view (p. 439) that "Chances of discovery of new mineral deposits of any extent and richness by ordinary geological methods are not many. . . ." The book itself refers to the gross inadequacies in knowledge about the geology of India, and as long as this situation continues we can be rather confident that major mineral discoveries are still to be made in that vast area. At least, this has been the history of progress in geological knowledge everywhere else, why not in India?

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Krankheiten und Schädlinge der Kulturpflanzen und ihre Bekämpfung. 7th ed. H. Braun and E. Riehm. Berlin, Germany: Paul Parey, 1953. 339 pp. Illus.

In 1910, Dr. Riehm published a small handbook dealing with the diseases and insect pests of crops in Germany. Since then six additional editions have appeared, each one a little larger and more detailed. The later ones had H. Braun as the senior author.

In the present edition are 28 pages of general discussion, followed by those for 23 special crops or

groups of crops. Cereals and potatoes include nearly one-third of the text. The life histories, 290 good illustrations, and descriptions of symptoms and causal organisms are valuable to the American entomologist and plant pathologist. But the control recommendations, based on a much lower economic scale than those of the U.S., have for the most part little value for the grower or the agricultural representatives in countries other than those of Europe. Because of the scope, ease in reading for the authors, and local adaptability of the German literature on the subject, nearly 600 of the 636 references are from German sources. The paper is of good quality, and the printing and general arrangement of the book are excellent.

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Bacterial Genetics. Werner Braun. Philadelphia–London: Saunders, 1953. 238 pp. Illus. $6.50.

Microbial genetics is advancing at a fast rate. Catcheside's *The Genetics of Micro-Organisms,* published in 1949, is already sadly out of date. Hence, Braun's *Bacterial Genetics,* as the second book in the field, is welcome. It does not replace Catcheside's book, however, because it is concerned with the genetics of bacteria alone, and because it is written at a different level. The student is likely to find Catcheside's work more demanding and, as a consequence, intellectually more stimulating. In *Bacterial Genetics* he will find clarity and pleasant reading. In this regard Braun comes close to his objective inasmuch as his book, like Catcheside's, is directed primarily to the nonmicrobial geneticist.

Braun apologizes in his preface for preoccupation with problems that he has illuminated by his own research. The reader will readily excuse him for, as a consequence, the book partakes of the flavor of those written by investigators and not mere reporters of the work of others. Despite this the coverage is good. There is an introductory chapter on some general genetic principles and one on the history of the field. Then follow chapters on bacterial cytology, mutation, mutagens, and representative types of mutants. There are also treatments of population changes brought about by mutation and selection and by other causes, of recombination, transformation, and transduction and a final chapter on the relation of bacterial genetics to general bacteriological problems. There are some omissions that might be rationalized, like the absence of a discussion of lysogenesis. In most cases where more rigorous theoretical treatments of problems are omitted, like Lea and Coulson's mathematical analysis of mutation, an illuminating reference is found in the text.

The specialist will find little in *Bacterial Genetics* with which to argue. He may, of course, have occasion to raise a point here and there but not with an unusual frequency. For example, he may regret that the word "adaptation" is not used in its broader biological context but is rather restricted to describe changes not brought about by mutation and selection. Or he might be surprised at the statement that it would be "extremely difficult" to reconstruct the selective conditions that exist where the frequency of mutants is as small as 10^{-8}—this can be done by the reciprocal use of marked stocks. He might object to the obsolete diagram of crossing over, to the confusion of the frequency of bacterial fusion with the frequency of recombinants, or to the suggestion that, for repetition of experiments, inocula should consist of single colonies. But it is likely his objections will be of a similar minor nature.

Braun's *Bacterial Genetics* is a good textbook for the student and for bacteriologists, biochemists, and geneticists who would desire a clear introductory statement about this rapidly growing field.

FRANCIS J. RYAN

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New Books

Sergei N. Winogradsky: His Life and Work. Selman A. Waksman. New Brunswick, N.J.: Rutgers Univ. Press, 1953. 150 pp. + plates. $4.00.

Standard Methods of Clinical Chemistry, Vol. I. By the American Association of Clinical Chemists, Miriam Reiner, Ed. New York: Academic Press, 1953. 142 pp. Illus. $4.50.

Electrical Methods of Blood-Pressure Recording. Frank W. Noble. Springfield, Ill.: Thomas, 1953. 56 pp. Illus. $3.00.

Einführung in die Lehre vom Adaptationssyndrom. Hans Selye; ed. and trans. from *The Story of the Adaptation Syndrome* by Heinz Köbcke, assisted by Rudolf Hoene and Gunnar Heuser. Stuttgart, Germany: Georg Thieme, 1953. 164 pp. Illus. DM 16.50.

A Simple Guide to Modern Valency Theory. G. I. Brown. London–New York: Longmans, Green, 1953. 174 pp. Illus. $2.50.

The Proteins: Chemistry, Biological Activity, and Methods, Vol. I. Part B. Hans Neurath and Kenneth Bailey, Eds. New York: Academic Press, 1953. 567 pp. Illus. $13.00.

Discontinuous Automatic Control. Irmgard Flügge-Lotz. Princeton, N.J.: Princeton Univ. Press, 1953. 168 pp. Illus. $5.00.

Biologia Generale. Emanuele Pàdoa. Torino, Italy: Edizioni Scientifiche Einaudi, 1953. 707 pp. Illus. L. 8000.

An American in Europe. The Life of Benjamin Thompson, Count Rumford. Egon Larsen. New York: Philosophical Library, 1953. 224 pp. + plates. $4.75.

Silicones and Their Uses. Rob Roy McGregor. New York: McGraw-Hill, 1954. 302 pp. Illus. $6.00.

Magnetic Amplifiers. George M. Ettinger. London: Methuen; New York: Wiley, 1953. 88 pp. Illus. $1.50.

Strahlenschutz und sonstiger Arbeitsschutz bei der medizinischen Anwendung von Röntgenstrahlen. Wilhelm Ernst. Stuttgart, Germany: Georg Thieme, 1953. 97 pp. Illus. DM 7.80.

Practical Methods in Biochemistry. 6th ed. Frederick C. Koch and Martin E. Hanke. Baltimore, Md.: Williams & Wilkins, 1953. 537 pp. Illus. $5.00.

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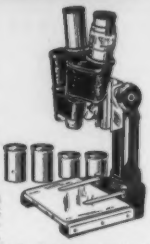

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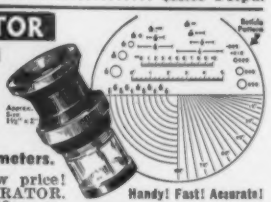

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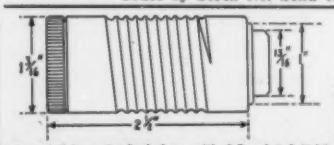

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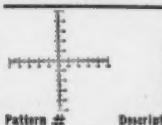

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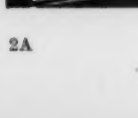

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75th Anniversary of the United States Geological Survey, March 3, 1954

THIS year the U.S. Geological Survey celebrates its 75th anniversary.

During the first six decades of the 19th century the surveys conducted by the National Government were chiefly exploratory in character and were confined almost wholly to the western country. Following the end of the Civil War, four surveying expeditions were sent out to explore and map the geology and resources of the then little-known country between the Rocky Mountains and the Pacific Coast. Usually referred to as the King, Wheeler, Hayden, and Powell surveys, the first two were sponsored and financed by the War Department, the others by the Department of the Interior.

In March, 1879, on the advice of the National Academy of Sciences, the 45th Congress enacted legislation providing for the establishment of the Geological Survey. This new branch of the Government was created expressly to merge the functions of the earlier expeditions into a single organization.

The functions of the new Bureau were defined in the organic act as ". . . the classification of the public lands and the examination of the Geological Structure, mineral resources, and products of the national domain . . ." and it was further provided "that the Director and members of the Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations. . . ." At the time of its inception the Geological Survey operated only in the western states which then as now included the bulk of public lands. A few years later the authorization was extended by Congress to cover the United States, its territories, and island possessions.

Under this charter, broadly interpreted by Clarence King, the first director, and more vigorously by John Wesley Powell, his successor, the major types of activity were blocked out, which the Survey has followed throughout its history. During Powell's term of office (1881–1894) he successfully established the Survey as a scientific and technical bureau with emphasis on research.

The Geological Survey has been referred to as the "mother of bureaus." It organized, nurtured, and directed activities in the field of natural resources in a very broad sense. In the course of expanding national development many of these activities, when they reached maturity, were relinquished to form independent bureaus, such as the Forest Service (1905), the Reclamation Service (1907, now the Bureau of Reclamation), the Bureau of Mines (1910), and the Grazing Service (1934, now part of the Bureau of Land Management).

Today the Survey's functions consist of geologic investigations, topographic mapping, water investigations, public-land classification, and mineral-leasing supervision on leased public and Indian lands. Its work is seldom of a spectacular nature and does not usually produce startling headlines in the daily press. Down through the years it has consistently chosen to remain an unbiased fact-finding and investigative professional agency.

As the Geological Survey celebrates its 75th anniversary, it looks ahead to increasing opportunities to contribute to the advancement of science and to the common welfare of the Nation.

W. E. WRATHER

Director of the
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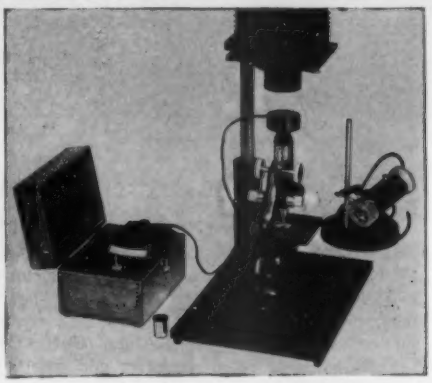

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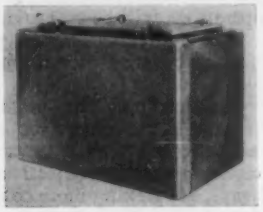

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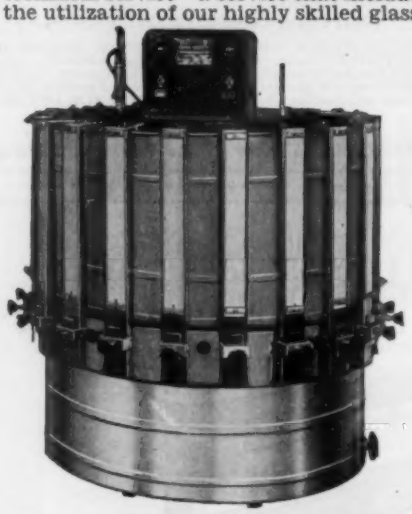

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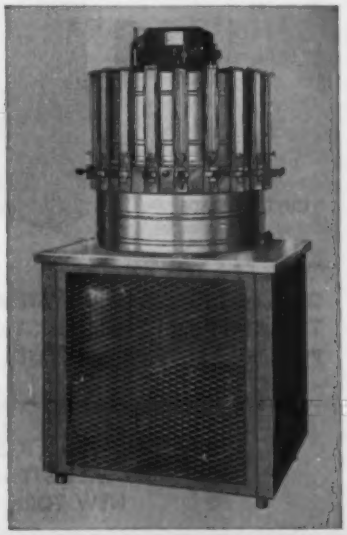

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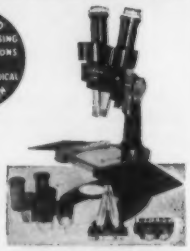

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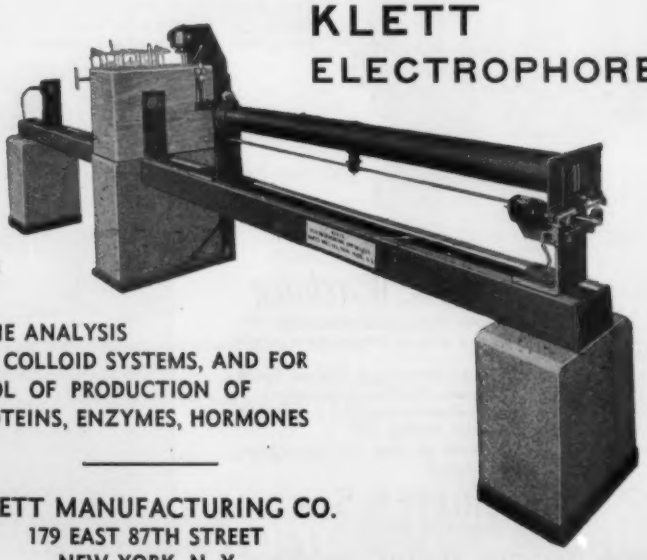

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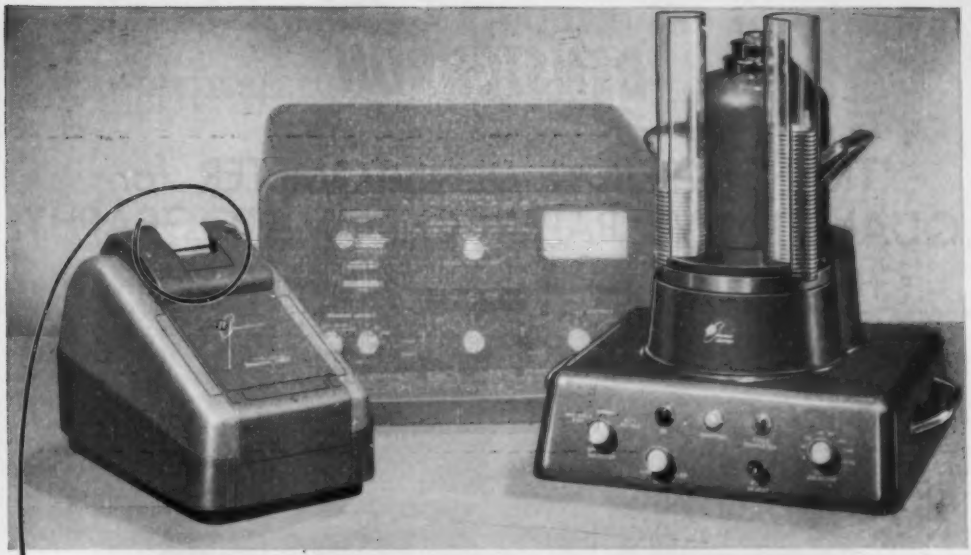

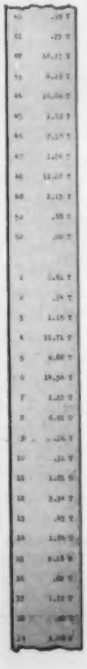

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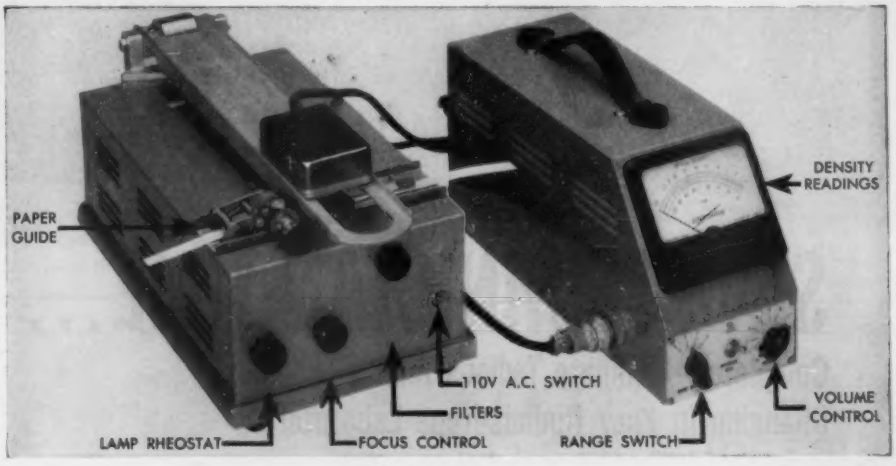

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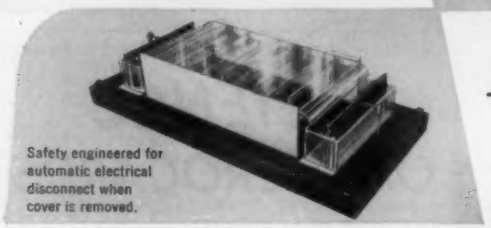

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1–3. National Science Teachers Assoc., annual, Chicago, Ill. (R. H. Carleton, 1201 16 St., NW, Washington 6, D. C.)

2–3. American Assoc. of University Professors, Buffalo, N. Y. (R. E. Himstead, 1785 Massachusetts Ave., NW, Washington 6, D. C.)

2–3. Assoc. of Geology Teachers, New England Section, 1st annual, Burlington, Vt. (C. G. Doll, Dept. of Geology, Univ. of Vermont, Burlington.)

3–4. History of Science Soc., annual, Baltimore, Md. (Miss Dorothy Stimson, Goucher College, Towson 4.)

6–9. Conf. on the Physics of Particle Size Analysis, Nottingham, Eng. (Inst. of Physics, 47 Belgrave Square, London S.W. 1.)

7–9. American Assoc. of Anatomists, Galveston, Tex. (N. L. Hoerr, Western Reserve Univ. School of Medicine, 2109 Adelbert Rd., Cleveland 6, Ohio.)

7–10. Conf. on Luminescence, Cambridge, Eng. (S. T. Henderson, 47 Belgrave Square, London, S.W. 1.)

8–9. European Assoc. against Poliomyelitis, Paris, France. (Secretariat General, 130 Rue de Linthout, Brussels, Belgium.)

9–10. Eastern Psychological Assoc., annual, New York, N. Y. (Gorham Lane, Dept. of Psychology, Univ. of Delaware, Newark.)

9–11. Soc. for Applied Anthropology, New York, N.Y. (Mrs. E. Purcell, 61 W. 55 St., New York 19.)

10–11. American Acad. of Optometry, western regional, Berkeley, Calif. (D. B. Carter, School of Optometry, Univ. of California, Berkeley.)

11–15. American Physiological Soc., Atlantic City, N. J. (M. O. Lee, 2101 Constitution Ave., Washington 25, D. C.)

11–15. Soc. of Exploration Geophysicists, annual, St. Louis, Mo. (B. W. Sorge, c/o United Geophysical Co., Inc., P.O. Box M, Pasadena 15, Calif.)

12–13. Conf. on Diseases in Nature Transmissible from Animal to Man, 4th annual, College Station, Tex. (C. D. Leake, Univ. of Texas Medical Branch, Galveston.)

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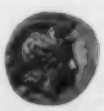

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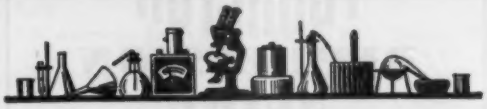

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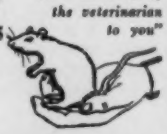

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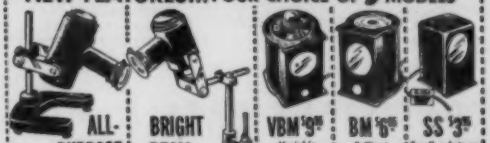

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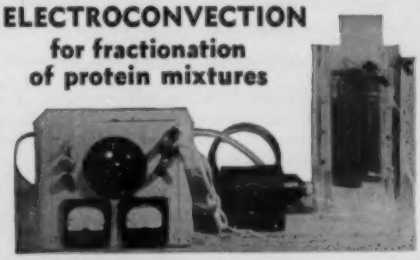

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